

IMPERIAL VALLEY COLLEGE/SAN DIEGO STATE UNIVERSITY  
TRANSIT SHUTTLE ANALYSIS  
FINAL TECHNICAL MEMORANDUM:  
Final Summary Report



August 2016

Prepared for:

Imperial County Transportation Commission (ICTC)

Southern California Association of Governments (SCAG)



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## Contents

1.0	Introduction To Executive Summary .....	2
2.0	Executive Summary – Review Of Public Input Process .....	3
3.0	Executive Summary – Phased Implementation Of Recommended Plan .....	7
4.0	Executive Summary – Estimated Impacts Of Recommended Plan .....	16
5.0	Executive Summary – Greenhouse Gas Emissions Analysis .....	18
6.0	Review Of Executive Summary .....	20
7.0	Introduction To Public Outreach Summary .....	21
8.0	Public Outreach Activities .....	22
9.0	Overview Of Public Input .....	27
10.0	Introduction To Existing Conditions .....	32
11.0	Community Overview .....	33
12.0	Prior Studies .....	38
13.0	Review And Evaluation Of Existing Transit Services .....	43
14.0	Evaluation Of Needs And Opportunities .....	51
15.0	Introduction To Development Of Route Alternatives .....	54
16.0	Development Of Alternatives .....	55
17.0	Identification Of Decision Criteria .....	68
18.0	Analysis Of Alternatives/Screening Process .....	71
19.0	Introduction To Implementation Of Recommended Plan .....	73
20.0	Phased Implementation Of Recommended Plan .....	74
21.0	Estimated Impacts Of Recommended Plan .....	86
22.0	Review Of Funding Sources .....	89
23.0	Greenhouse Gas Emissions Analysis .....	92
24.0	Summary Of Recommended Plan .....	96
	Outreach Schedules .....	98
	Fact Sheets In English And Spanish .....	100
	Questionnaire .....	102
	Guiding Questions .....	104
	Results From First Round Of Outreach .....	106
	Results From Second Round Of Outreach .....	108

## 1.0 INTRODUCTION TO EXECUTIVE SUMMARY

Three of the college campuses in the Imperial Valley – Imperial Valley College (IVC), near the City of Imperial, and San Diego State University-Imperial Valley (SDSU-IV), with campuses in both Calexico and Brawley – are part of a study team jointly led by the Imperial County Transportation Commission (ICTC) and the Southern California Association of Governments (SCAG) which was awarded a planning grant in early 2015 to pursue the development of a potential shuttle service linking the three facilities.

The IVC campus near the City of Imperial is currently served by several Imperial Valley Transit (IV Transit) routes. The SDSU-IV Calexico campus is not directly served by transit, although several IV Transit routes operate within walking distance. The SDSU-IV Brawley campus is currently unserved by transit.

The purpose of the Campus Transit Study is to recommend transit service and access improvements between the three campuses. These improvements may include creating a new dedicated transit service that serves the colleges as well as potentially leveraging existing bus service.

This study is a collaborative effort between IVC and SDSU-IV – and their collaborative Imperial Valley University Partnership (IVUP) program – and ICTC and SCAG. The IVUP program is a collaborative effort between IVC and SDSU-IV to create intercollegiate programs as well as to create a path for IVC students and graduates to transition to SDSU programs and coursework.

This Executive Summary describes the public outreach effort that informed the planning process throughout this study, as well as the phased implementation plan for a recommended set of services that may serve all of these campuses.

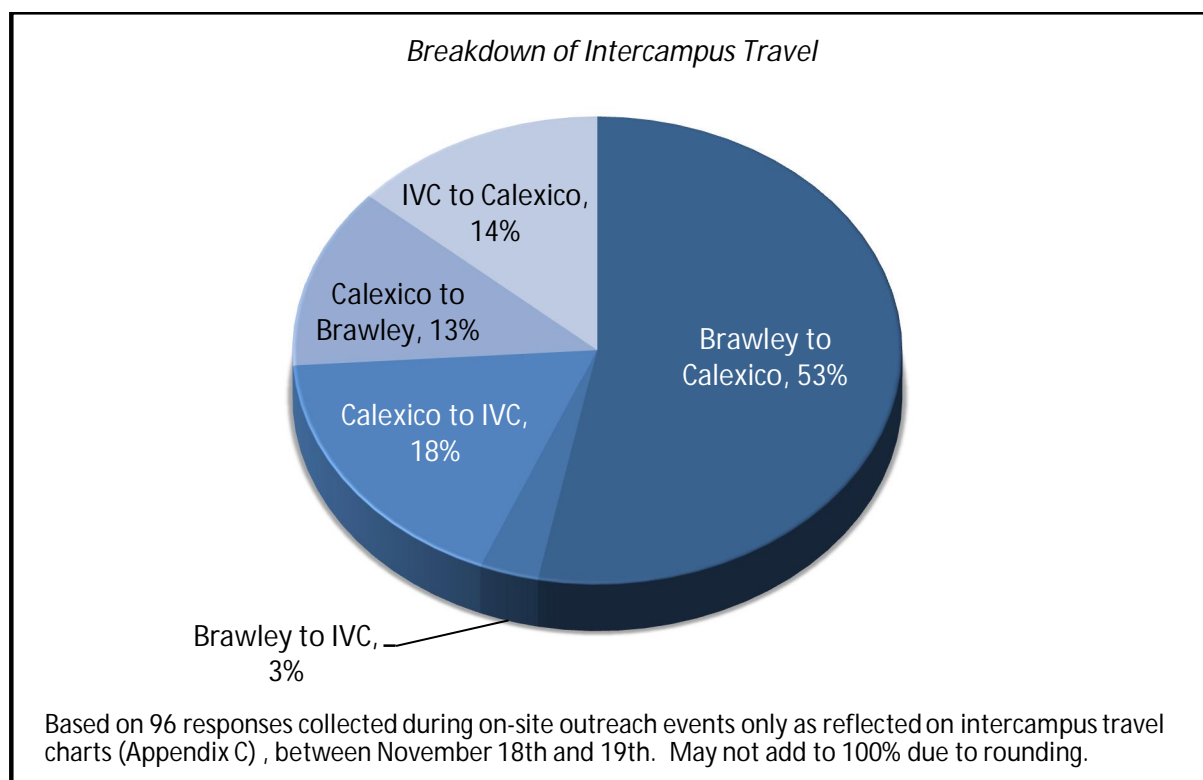
## 2.0 EXECUTIVE SUMMARY – REVIEW OF PUBLIC INPUT PROCESS

Two rounds of public outreach activities took place for the Campus Transit Study. Initial public outreach efforts took place in November 2015, and gathered focused input from over 300 participants on intercampus travel patterns, student ridership, and other information to provide guidance on transit improvements. Based on initial public input, transit alternatives were developed to suit popular interests.

The second round of public outreach activities took place in April 2016, where transit alternatives were presented to the college communities. More than 100 people participated in the outreach activities to review transit alternatives and provide input to refine and prioritize the alternatives.

### First Round of Outreach

According to the intercampus travel charts, trips starting from SDSU-Brawley and ending at SDSU-Calexico were most common, accounting for roughly 53%, followed by trips between SDSU-Calexico and IVC (roughly one-third).



Of the most common intercampus trips documented by participants, travel from SDSU-Brawley to SDSU-Calexico was most frequent during the afternoon (roughly 38% of participants’

intercampus trips), followed by IVC to SDSU-Calexico in the afternoon (13%) and SDSU-Brawley to SDSU Calexico in the evening (12%).

The following main trends were revealed:

- Over 90% of questionnaire respondents want bus service between the college campuses.
- Current IV Transit ridership within the sampled college communities is around 19%.
- Driving (74%) was identified as the main reason for not taking IV Transit, while bus fares were not viewed as a barrier to taking transit.
- 42% of questionnaire respondents attend two college campuses, while nearly 7% attend all three, collectively comprising a total of 49% of the respondents currently having intercampus commutes.
- Nearly all survey respondents were students (98%), with little participation by instructors and staff.
- 21% of the questionnaire respondents were currently cross-enrolled between SDSU-Imperial Valley and IVC.

Table 1 – Breakdown of Intercampus Travel by Time of Day

FROM > TO	Morning	Afternoon	Evening
Brawley > Calexico	4%	38%	11%
Brawley > IVC	0%	2%	1%
Calexico > Brawley	0%	5%	7%
Calexico > IVC	4%	5%	8%
IVC > Brawley	0%	0%	0%
IVC > Calexico	0%	13%	1%

Frequency
0% - 5%
5.01% - 10%
10.01% +

## Second Round of Outreach

Nearly 500 sticker dots were placed on all the boards from the outreach events, amongst a total of 118 participants. The boards described the various aspects of each of the potential service options, and are described in greater detail in a subsequent section of this report. Table 2 provides the percentage breakdowns of participants' votes for preferred service alternatives based on the alternative routes and services that were presented.

Over 50% of the participants were in favor of "Option A" (where IVC serves as a transfer point with buses circulating from SDSU-Brawley to IVC and SDSU-Calexico to IVC). "Option C" (where service is provided to the SDSU Main Campus in San Diego) was also highly favorable amongst participants with approximately 27% of the votes. ("Option B" included the SDSU Express service option, and "Option D" provided service to Northern Arizona University in Yuma.)

Table 2 – Breakdown of Service Route Preferences based on Participants' Votes

Campus	A	B	C	D	Participants Per Event
IVC Bus Stop	57.3%	7.3%	21.9%	13.5%	24
IVC Bldg 2700	50.4%	7.2%	31.1%	11.4%	66
SDSU-Brawley Lobby	25.0%	43.8%	18.8%	12.5%	4
SDSU-Calexico Quad	51.0%	19.8%	22.9%	6.3%	24
	51.1%	11.0%	27.1%	10.8%	118

Some comments specific to alternative services were as follows:

Option A:

- The level of ideal service frequency suggested by participants widely varied to include 30 minute, 45 minute, and 2 to 3 hour intervals between buses.
- Frequent service every 30 to 45 minutes seemed to align with preferences for flexibility in schedules (based on school and work).
- It was noted by several participants that the service provided in Option A could exist with some adjustments to current transit routes.

Option B:

- The start times of 10:30AM and noon were suggested by participants since IVUP students have morning classes at SDSU-Calexico.

Option C:

- Service frequency suggestions were recommended for every 2, 2 ½, and 3 hours.
- Extended service hours for later return times ranged between 7PM and 10PM to be on the safe side for those wanting to take late-afternoon classes, attend group meetings, and/or participate in on-campus events at SDSU's main campus in San Diego.

Option D:

- Service frequency suggestions were recommended for every 1 or 2 hours.

Participants noted that Options C and D may be expensive to implement and operate, but provides a greatly needed service in the long-run due to the connections between the three college campuses and SDSU in San Diego, and NAU-Yuma.

### 3.0 EXECUTIVE SUMMARY – PHASED IMPLEMENTATION OF RECOMMENDED PLAN

Several route and service alternatives were developed that would connect the three campuses – Imperial Valley College (IVC) and the San Diego State University (SDSU) – Imperial Valley satellite campuses in Calexico (SDSU-Calexico) and Brawley (SDSU-Brawley).

After a screening process, some of the route and service alternatives were eliminated from further consideration. The remaining route and service alternatives were then developed into a recommended plan, which is presented here. This recommended plan of services is also presented with its implementation phases, so as to allow for this new service in the Imperial Valley to be implemented gradually, as funding becomes available.

The phased implementation process for the recommended plan is as follows:

#### Phase 1 – Implement IVC Transfer Concept

This initial phase is expected to be implemented between 2017 and 2025. With this phase, the IVC/SDSU-Calexico and IVC/SDSU-Brawley Shuttle Routes will be implemented, thus connecting the IVC campus with both of the SDSU campuses.

However, as has been previously noted, a person wishing to travel between the SDSU campuses will need to transfer at IVC, which will function as a “hub” for the shuttle system. Phase 1 is illustrated in Figure 1.

The service plan for Phase 1 is as follows:

- SDSU-Brawley/IVC Route is estimated to require approximately 60 minutes cycle time, and would utilize 1 bus to provide a 60 minute frequency of service
  - Service would operate from approximately 12:00PM to 10:30PM when school is in session
  - Would serve the IVC campus, the South Plaza transit center in Brawley and the SDSU-Brawley campus
- SDSU-Calexico/IVC Route is also estimated to require approximately 60 minutes cycle time, and would also utilize 1 bus to provide a 60 minute frequency of service
  - Service would operate from approximately 6:00AM to 10:30PM when school is in session
  - Would serve the IVC campus and the SDSU-Calexico campus



Figure 1 – Phase 1 Service – IVC Transfer Concept



#### Phase 2 – Implement SDSU Express Shuttle Route In Addition to IVC Transfer Concept

The second (and final) phase is expected to be implemented between 2020 and 2028. With this phase, the IVC/SDSU-Calexico and IVC/SDSU-Brawley Shuttle Routes will be complemented by the implementation of the SDSU Express Shuttle Route, which operates “express” between the two SDSU campuses.

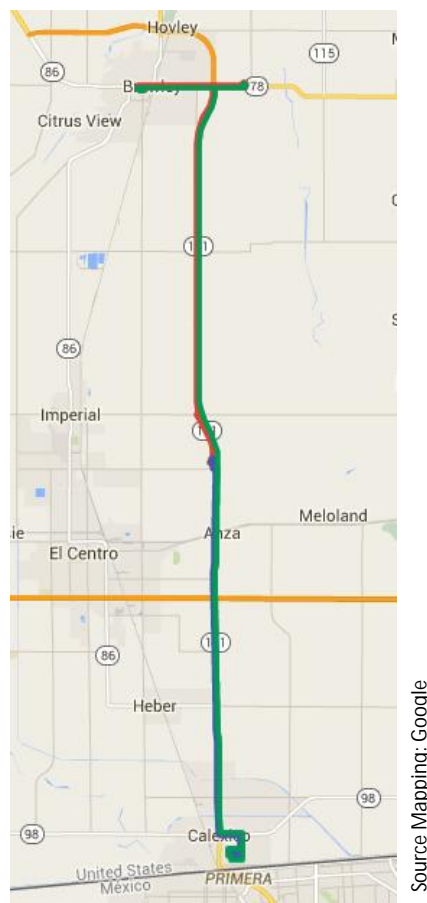
This service pattern allows any passenger traveling between any campus to have a “one seat ride” that does not require a transfer. Phase 2 is illustrated in Figure 2.

The service plan for Phase 2 is as follows:

- SDSU-Brawley/IVC Route is estimated to require approximately 60 minutes cycle time, and would utilize 1 bus to provide a 60 minute frequency of service

- Service would operate from approximately 12:00PM to 10:30PM when school is in session
- Would serve the IVC campus, the South Plaza transit center in Brawley and the SDSU-Brawley campus
- SDSU-Calexico/IVC Route is also estimated to require approximately 60 minutes cycle time, and would also utilize 1 bus to provide a 60 minute frequency of service
  - Service would operate from approximately 6:00AM to 10:30PM when school is in session
  - Would serve the IVC campus and the SDSU-Calexico campus
- SDSU-Calexico/SDSU-Brawley Express Route is estimated to require approximately 90 minutes cycle time, and would utilize 1 bus to provide a 90 minute frequency of service
  - Service would operate from approximately 12:00PM to 10:30PM when school is in session
  - Would serve the SDSU-Calexico campus, the South Plaza transit center in Brawley and the SDSU-Brawley campus

Figure 2 – Phase 2 Service – Implement SDSU Express Shuttle Route



## Longer Term Phases

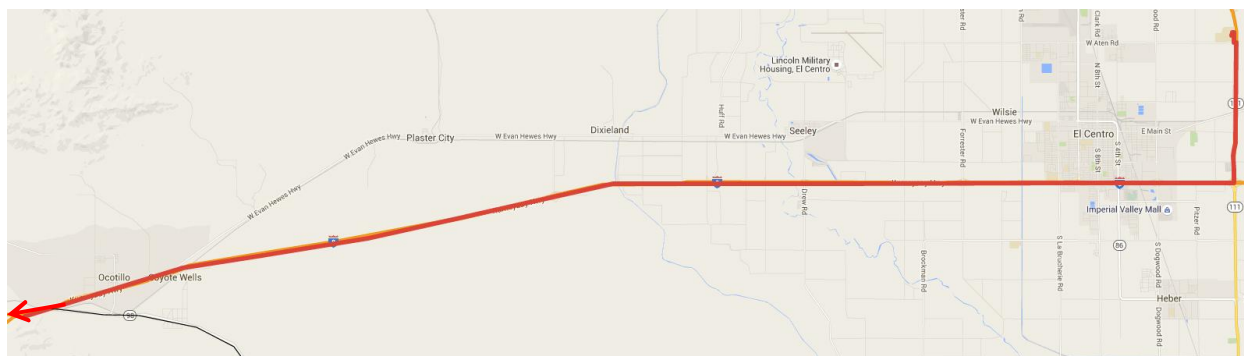
There are several service options which do not fit the current funding structure for providing public transportation services in the Imperial Valley, and thus would be implemented in the “longer term” (i.e., at some point after the completion of Phase 2). These phases serve locations outside of Imperial County, and as such extra-jurisdictional services fall outside the normal funding mechanisms utilized by the Imperial County Transportation Commission.

No detailed metrics beyond those utilized to estimate operating costs were developed for these services. Nonetheless, the potential exists to operate these services in the longer term, depending on the ability to obtain additional funding from sources that may, for example, include the academic institutions.

The potential longer term phases are as follows:

- Phase 3 – Implement SDSU Main Campus Service – In this longer-term phase, shown in Figure 3, service would be provided between the IVC campus and the SDSU Main Campus in San Diego primarily via Interstate 8.

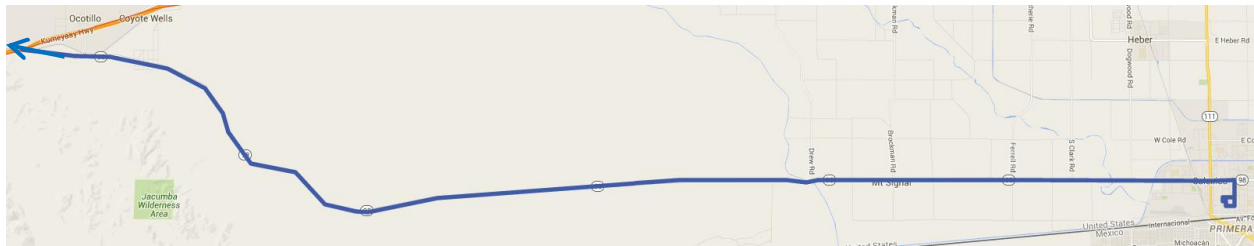
Figure 3 – SDSU Main Campus Service from IVC



Source Mapping: Google

- Alternative Phase 3 – Implement SDSU Main Campus Service from SDSU-Calexico – As the option presented previously requires SDSU-Calexico students to first travel to or from IVC in order to travel to or from the SDSU Main Campus, an alternative option would instead provide the SDSU Main Campus service from SDSU-Calexico, as shown in Figure 4. This service would operate via State Route 98 (in Imperial County) and Interstate 8.

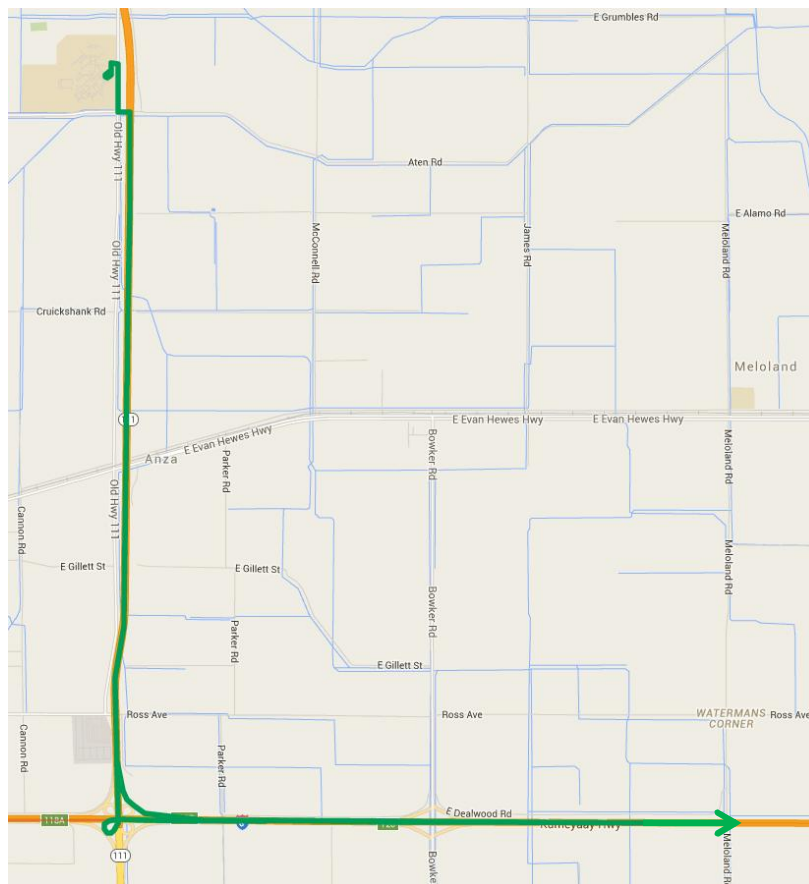
Figure 4 – SDSU Main Campus Service from SDSU-Calexico



Source Mapping: Google

- Phase 4 – Implement Northern Arizona University (NAU) Yuma Campus Service – In this ultimate longer term option, service would be provided between the IVC campus and the NAU Yuma Campus (primarily via Interstate 8), as shown in Figure 5.

Figure 5 – NAU Yuma Campus Service



Source Mapping: Google

## Bus Stop Locations

In addition to utilizing the existing bus stops at the IVC campus and at the South Plaza transit center in Brawley, the proposed shuttle service alternatives would also use new bus stops at the SDSU-Brawley and SDSU-Calexico campuses.

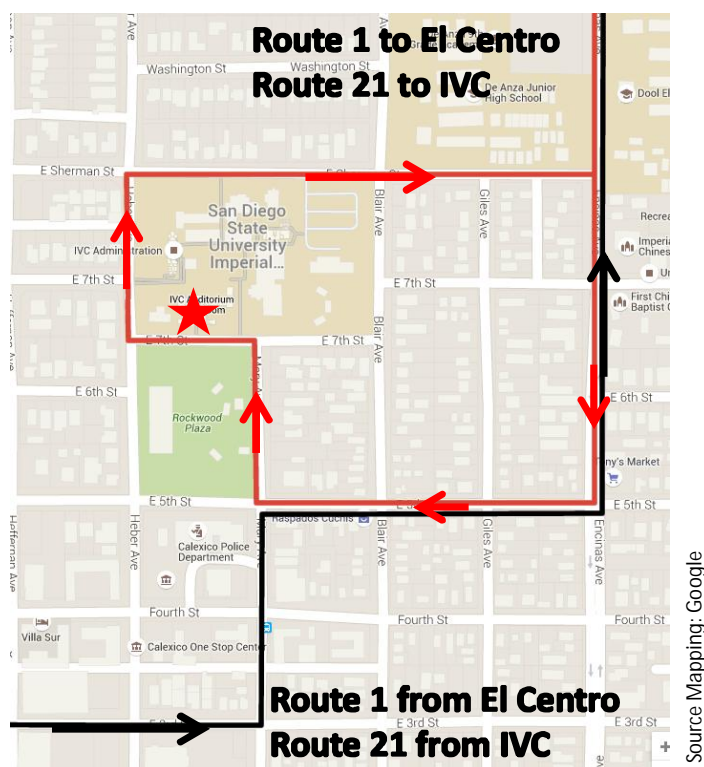
At the SDSU-Brawley campus, the new bus stop would be located along the front of the classroom building (i.e., the sole building on that campus), as indicated by the star shown in Figure 6.

Figure 6 – New SDSU-Brawley Bus Stop Location



The SDSU-Calexico campus is not directly served by the IV Transit system; however, several IV Transit routes are within walking distance. At the SDSU-Calexico campus, the new bus stop would be located along East 7<sup>th</sup> Street at the “main entrance” to the campus, as indicated by the star shown in Figure 7. Also shown are the existing IV Transit routes in the area.

Figure 7 – New SDSU-Calexico Bus Stop Location



It is assumed that each of the new bus stops would be equipped with a passenger waiting shelter as well as benches. The appropriate signage and trash containers will also be provided. It assumed – for the planning purposes of this study – that SDSU will maintain the two new bus stops, as they will be directly serving its facilities.

#### Vehicle Number and Type

The service plan described above would require two vehicles in Phase 1 and three vehicles in Phase 2. With the need for a spare vehicle, this means that a total of three vehicles in Phase 1 and four vehicles in Phase 2 would be required to provide the recommended level of service.

It was determined that a standard transit bus – most likely in a 35 foot length – be recommended to provide the academic shuttle service in the Imperial Valley. A standard transit bus is shown in Figure 8. Although various factors were considered, the following were especially pertinent:

- Retains a level of commonality and interoperability with the existing fleet (and therefore is likely to reduce life cycle maintenance costs);
- Standard transit bus frames typically have the most options available in terms of alternative powerplants and fuel sources, which will allow for the most flexibility in

selecting an alternative fuel bus for the service (and which will be discussed in a subsequent section of the report); and

- The size of a standard transit bus would mean that should higher loads occur at particular times of day or on a certain repeating basis, a more comfortable ride along State Route 111 would be provided as more passengers would be likely to obtain a seat.

Figure 8 – Standard Transit Bus



### Other Transit Considerations

There are several additional transit planning considerations that should be explicitly described as part of this recommended plan. These are as follows:

- Ridership Eligibility – Throughout this report, it has been assumed that the Imperial County Transportation Commission would administer this academic shuttle service, and – most likely – integrate it into the existing IV Transit service (whether via the existing contract operator or by another contractor). If this service is to be part of the IV Transit system, then it must be available to the general public and not solely to members of the academic community.
- Stopping Pattern – It is assumed that the routes described in this recommended plan will only stop at the bus stops described in the route descriptions previously stated. Therefore, the shuttle services will provide an express “closed door” bus service between stops, and not make any additional stops.
- Fare/Transfer Policy – It is assumed that integration with the existing IV Transit fare structure will be undertaken in order to maximize convenience and increase potential ridership. In addition, this allows for no “fare advantage” to using any of the new shuttle routes as opposed to the existing IV Transit services.
- Branding – All three of the new shuttle services described in this recommended plan will be branded as the “*Imperial Valley University Transit Shuttle*”. Although it is recognized that branding such a small “sub-fleet” may create some dispatching issues



for an operator, the study team determined that the benefits to a strong branding identity would allow not only the students but also the academic institutions themselves to have a stronger “sense of ownership” with regard to the service.

- Operating/Maintenance/Storage Facility Considerations – Adding four new buses to the existing IV Transit fleet shouldn’t pose any issues with regards to the existing operating and maintenance base or its operator.

However, it should be noted that should an alternative fuel source be selected to provide this service (i.e., especially should it be one that differs from the current fuel source), then additional capital infrastructure needs may be necessary, depending upon the fuel source selected.

- Personnel – By Phase 2 of the recommended plan there will be three additional peak vehicles required to provide the service. In terms of personnel needs, the number of new bus operators needed may vary depending on how the operator schedules drivers and any potential contractual agreements regarding such driver scheduling. Nonetheless, should the service be operated, it can be expected that there would be a need for new bus operators (i.e., likely approximately 3 to 6 new drivers). Should the existing operator operate the service, existing supervisory and maintenance personnel would likely be able to be utilized.



## 4.0 EXECUTIVE SUMMARY – ESTIMATED IMPACTS OF RECOMMENDED PLAN

The recommended plan was further analyzed in order to develop additional metrics by which to gauge the potential efficacy of the service plan. These included approximate estimates – for planning purposes – of total operating costs, capital costs, ridership, revenue and farebox recovery.

### Annual Operating Cost Estimates

The total annual operating cost estimates are as follows:

- Phase 1
  - SDSU Brawley-IVC Route = \$248,100/year
  - SDSU Calexico-IVC Route = \$389,900/year
  - TOTAL Phase 1 Cost = \$638,000/year
- Phase 2
  - SDSU Brawley-SDSU Calexico Express = \$248,100/year
  - TOTAL Phases 1 & 2 Cost = \$886,200/year

### Capital Cost Estimates

These are as follows:

- New Bus Stops = approximately \$40,000
  - This assumes a capital cost of approximately \$20,000/bus stop, with one at SDSU-Brawley and one at SDSU-Calexico.
- New standard transit buses = approximately \$3,000,000 in vehicle costs
  - This assumes a unit cost of approximately \$750,000 per bus for an alternative fuel (or electric) bus. Costs may vary; however, an examination of approximate vehicle costs appears to indicate that this assumption is appropriate for planning purposes.
  - This also assumes three vehicles are needed for revenue service by Phase 2, with an additional spare bus (i.e., utilizing a 20% spare ratio).

### Annual Ridership and Revenue Estimates and Farebox Recovery Estimates

The estimated annual ridership, revenue and farebox recovery, by phase, are as follows:

- Phase 1 Estimates
  - Phase 1 Annual Ridership
    - SDSU Brawley-IVC Route = 19,000/year
    - SDSU Calxico-IVC Route = 59,700/year (*approximately 30,000/year from existing IV Transit Route 21*)
    - TOTAL Phase 1 Ridership = 78,700/year
  - Phase 1 Annual Revenue
    - SDSU Brawley-IVC Route = \$23,700/year
    - SDSU Calxico-IVC Route = \$74,600/year
    - TOTAL Phase 1 Revenue = \$98,300/year
  - Phase 1 Farebox Recovery = 15%
- Phase 2 Estimates
  - Phase 2 Annual Ridership
    - SDSU Brawley-IVC Route = 14,200/year
    - SDSU Calxico-IVC Route = 44,800/year (*approximately 30,000/year from existing IV Transit Route 21*)
    - SDSU Calxico-SDSU Brawley Express Route = 27,400/year
    - TOTAL Phase 2 Ridership = 86,400/year
  - Phase 2 Annual Revenue
    - SDSU Brawley-IVC Route = \$17,800/year
    - SDSU Calxico-IVC Route = \$56,000/year
    - SDSU Calxico-SDSU Brawley Express Route = \$34,300/year
    - TOTAL Phase 2 Revenue = \$108,100/year
  - Phase 2 Farebox Recovery = 12%

## 5.0 EXECUTIVE SUMMARY – GREENHOUSE GAS EMISSIONS ANALYSIS

The greenhouse gas (GHG) emissions for the proposed transit shuttle routes between Imperial Valley College (IVC) and the San Diego State University (SDSU) satellite campuses in Brawley and Calexico were also analyzed. The recommended plan includes three potential transit routes that will be implemented in two phases from 2017 to 2028. The Imperial County Transportation Commission (ICTC), the Southern California Association of Governments (SCAG), IVC and SDSU are considering different engine and fuel types (e.g., diesel, electric, etc.) for the buses that will operate on the transit routes.

### Results

The results of the emission calculations are presented in Tables 1 through 4. Table 1 presents the annual GHG emissions for the different transit fuel types for Phase 1 of the project. As shown in Table 1, diesel and CNG buses would result in the largest net increase in GHG emissions at 363 and 312 metric tons of carbon dioxide equivalents (MT CO<sub>2</sub>e) per year, respectively. Electric buses would result in the lowest level of GHG emissions at 88 MT CO<sub>2</sub>e per year.

Table 1 – Phase 1 Bus Emissions (MT CO<sub>2</sub>e/yr)

Fuel Type	Brawley-IVC Route Emissions	Calexico-IVC Route Emissions	Total Bus Emissions
Diesel	162.41	200.65	363.06
CNG	139.54	172.40	311.94
Electric	39.57	48.89	88.46
Hydrogen	87.91	108.60	196.51

Table 2 presents the total net change in emissions for the different routes in Phase 1 based on the change in bus emissions and the corresponding VMT reduction in passenger vehicles. Consistent with the results in Table 1, electric buses would result in the most substantial reduction in GHG emissions at 196 MT CO<sub>2</sub>e per year.

Table 2 – Phase 1 Net Change in Emissions (MT CO<sub>2</sub>e/yr)

Fuel Type	Brawley-IVC Route	Calexico-IVC Route	Total Net Change in Emissions
Diesel	33.59	45.17	78.76
CNG	10.73	16.92	27.64
Electric	-89.25	-106.60	-195.85
Hydrogen	-40.91	-46.88	-87.79

Table 3 presents the annual GHG emissions for the different transit fuel types for Phase 2 of the project. Similar to the results of Phase 1, diesel and CNG buses would result in the largest net increase in GHG emissions. Electric buses would result in the lowest level of GHG emissions.

Table 3 – Phase 2 Bus Emissions (MT CO<sub>2</sub>e/yr)

Fuel Type	Brawley-IVC Route	Calexico-IVC Route	SDSU Calexico-Brawley Route	Total Bus Emissions
Diesel	162.41	200.65	193.56	556.62
CNG	139.54	172.40	166.31	478.25
Electric	39.57	48.89	47.16	135.62
Hydrogen	87.84	108.52	104.69	301.06

Table 4 presents the total net change in emissions for the different routes in Phase 2 based on the change in bus emissions and the corresponding VMT reductions in passenger vehicles. Similar to Phase 1, electric buses operating in Phase 2 would result in the most substantial reduction in GHG emissions. Hydrogen buses would also result in a net reduction in GHG emissions. Diesel and CNG buses would result in an overall net increase in annual GHG emissions. Based on the overall distance, annual ridership, and vehicle trips, the SDSU-Calexico/SDSU-Brawley Route would result in a net reduction in GHG emissions for all fuel types.

Table 4 – Phase 2 Net Change in Emissions (MT CO<sub>2</sub>e/yr)

Fuel Type	Brawley-IVC Route	Calexico-IVC Route	SDSU Calexico-Brawley Route	Total Net Change
Diesel	74.89	130.21	-93.97	111.13
CNG	52.02	101.96	-121.22	32.76
Electric	-47.95	-21.55	-240.37	-309.87
Hydrogen	0.32	38.09	-182.84	-144.43

## 6.0 REVIEW OF EXECUTIVE SUMMARY

The recommended plan for the proposed academic shuttle service consists of three new routes that would be implemented over two primary phases; it is anticipated that these services would operate only during the academic year.

This recommended plan will also be evaluated as part of the upcoming Short Range Transit Plan (S RTP) to be prepared by the Imperial County Transportation Commission.

## 7.0 INTRODUCTION TO PUBLIC OUTREACH SUMMARY

### Project Overview

The purpose of the Imperial Valley College/San Diego State University Transit Study (Campus Transit Study) is to recommend improvements to transit access to three college campuses in the Imperial Valley (Imperial Valley College, San Diego State University-Brawley, and San Diego State University – Calexico). These improvements may include creating a new transit service that serves the three colleges and/or leveraging existing bus service. This study is a collaborative effort between Imperial County Transportation Commission (ICTC), Imperial Valley College (IVC), San Diego State University – Imperial Valley (SDSU-IV) and the Southern California Association of Governments (SCAG).

### Public Outreach Overview

Two rounds of public outreach activities took place for the Campus Transit Study. Initial public outreach efforts took place in November 2015, and gathered focused input from over 300 participants on intercampus travel patterns, student ridership, and other information to provide guidance on transit improvements. Based on initial public input, transit alternatives were developed to suite popular interests.

The second round of public outreach activities took place in April 2016, where transit alternatives were presented to the college communities. More than 100 people participated in the outreach activities to review transit alternatives and provide input to refine and prioritize the alternatives.

This memorandum describes the overall outreach efforts that took place at and a general trend in the information gleaned from the college campuses, and contains the following information:

- Descriptions of Outreach Activities
- Overview of Public Input

## 8.0 PUBLIC OUTREACH ACTIVITIES

The primary objective of the initial public outreach activities held in November 2015 was to gather focused input from college communities regarding transit use and desired transit service. This input was utilized in developing improvements to existing bus service. More than 300 people participated in the initial round of outreach activities. The initial public outreach was conducted as part of Step 3: Existing Conditions, and activities included passenger and campus questionnaires, and bilingual public workshops.

The second round of public outreach activities held in April 2015 aimed at gathering input from the college communities regarding alternative transit service strategies and routes developed based on initial interest from November 2015. This input was used to further refine alternative transit routes. More than 100 people participated in these outreach activities. The second round of outreach was conducted as part of Step 4: Alternatives Analysis, and activities consisted of informal workshops where participants were presented with transit service alternatives and provided feedback on proposed routes and service frequencies.

### *Outreach Activities by Phase*



Multiple public participation options were provided during both rounds of outreach to make it as easy as possible for interested individuals to provide input. Complete schedules for both rounds of outreach are provided in Appendix A.

Outreach activities consisted of interactive public workshops and questionnaires. Further explanation of outreach activities is provided in this section.

## Outreach Campaign

Notification and outreach campaigns took place in early November and early April for the first and second round of outreach activities, respectively, to generate awareness of and interest in the Campus Transit Study. The campaigns consisted of the following elements:

Outreach Elements	Outreach Round		Description
	1	2	
Fact Sheets	X	X	Produced in English and Spanish, with information about the Campus Transit Study, a link to the ICTC webpage, and dates for the outreach activities. These fact sheets were posted in highly visible areas on the college campuses and Imperial Valley Transit buses, as well as online.
Social Media Posts	X	X	Postings were drafted and sent to key campus contacts to disseminate on social media outlets. The goal was to generate interest by utilizing existing media networks frequented by the college communities.
Email Blasts	X	X	Content was drafted and sent to key campus contacts to disseminate throughout various college list serves before the on-campus activities. The colleges send regular email blasts to students regarding upcoming and weekly activities around campus, and these email notifications provided additional direct communications with the target audience for the Campus Transit Study.
Bookmarks	X		Created in English and Spanish, these bookmarks contained hyperlinks and phone numbers for completion of the questionnaire. They were distributed around the college communities to help “spread the word” regarding the questionnaire, and were also utilized to randomly select prize winners from participants during the initial outreach activities.



*Bookmarks provided during the first round of outreach, with a phone number for the questionnaire and the link to ICTC's Campus Transit Study webpage.*



## Passenger and Campus Questionnaires

The passenger and campus questionnaires were utilized only for the first round of outreach to gain a better understanding of current transit use/experience and ideal transit service of the college communities, including students, faculty, and staff. The questionnaire was offered in English and Spanish and participants had the option of completing the questionnaire via text, online, and in-person (questionnaire included in Appendix B).

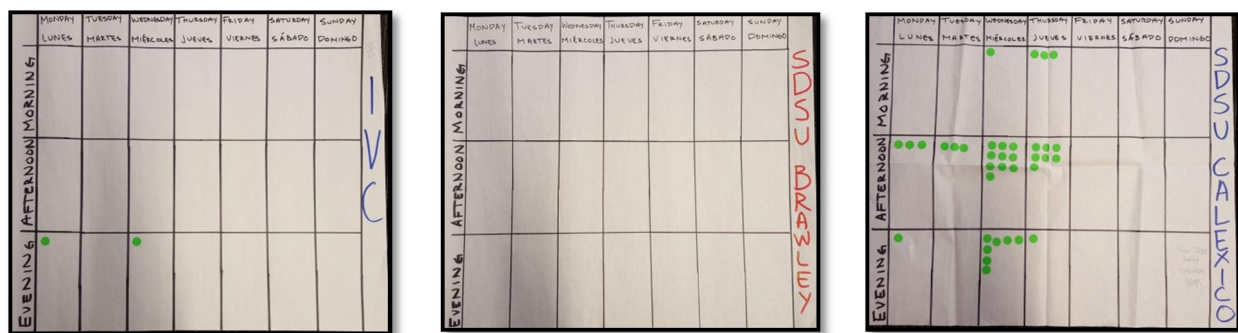
The questionnaire was made available online and via text for an additional week and a half following the on-campus initial outreach activities to maximize opportunities for participation by the campus community.

## Public Workshops

Public workshops were held during both rounds of outreach, in convenient and comfortable environments at campus bus stops or on the colleges in areas frequented by students. English and Spanish capabilities were provided at all times to ensure maximum capture of public input.

### *First Round of Outreach*

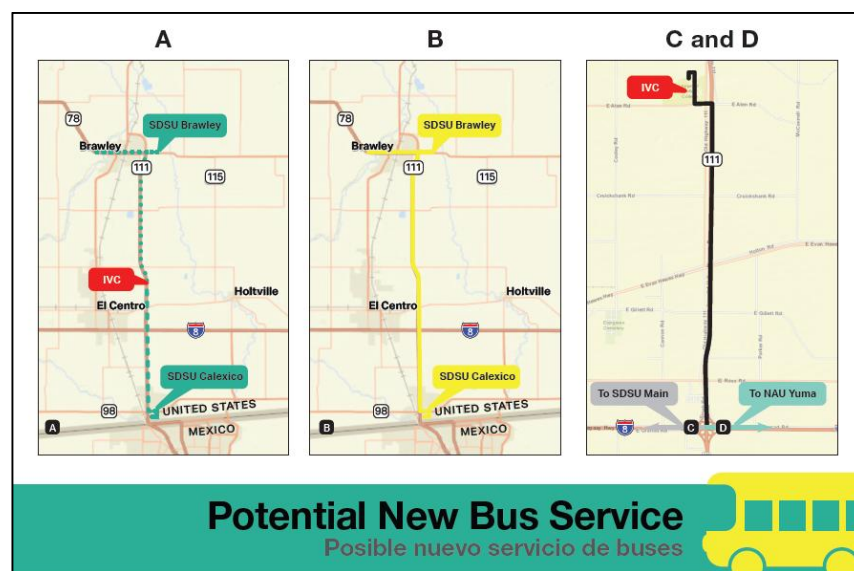
Three workshops were held in all, one at each campus. Outreach staff administered the questionnaires, followed by informal but more in depth one-on-one conversations with participants based on guiding questions. Additional interactive components of the workshops included intercampus travel charts, where participants were asked to place sticker dots to indicate the days and times they typically travel between campuses. This activity was meant to provide a quick visual snapshot of trends in travel patterns between campuses.




*Examples of Intercampus Travel Charts: Sticker dots placed by participants represent days and times generally traveled from (L) SDSU-Calexico to IVC, (M) IVC to SDSU-Brawley, (R) SDSU-Brawley to SDSU-Calexico.*

## *Second Round of Outreach*

Three workshops were held, one at each campus. Participants were presented with poster boards depicting alternative service routes while outreach staff explained each alternative option. Participants were then given four sticker dots each and directed to a second poster board to place the stickers next to alternatives of interest and preference. Placement of sticker dots was completely left to each participants' preference such that all four could be evenly distributed amongst the four route options, placed only on one route option, or however else in order to capture trends in popular interest. Follow-up questions pertaining to operation times and frequency of buses were asked by the outreach staff to the participants to gather input that would aid in further refining and prioritizing the alternatives.



*Poster board, showing the four service alternatives, used to explain the routes to workshop participants.*

WOULD YOU USE THESE BUS ROUTES? ¿UD. USARÍA ESTAS RUTAS DE BUS?			HOW OFTEN SHOULD THE SHUTTLE RUN? ¿CUÁN SEGUIDO CREE UD. QUE EL BUS DEBERÍA PASAR?		
A	All 3 Campuses + IVC Transfer		A	Hourly Brawley: 3pm - 10:30pm Calexico: 6am - 10:30pm	
B	SDSU Calexico & SDSU Brawley Express		B	Every 90 mins 3pm - 10:30pm	
C	IVC - SDSU Main Campus		C	Every 4 ½ hrs 6am - 6pm	
D	IVC - NAU Yuma		D	Every 3 hrs 6am - 6pm	
ANY SUGGESTIONS? ¿TIENE ALGUNA SUGERENCIA?			<p>¡GRACIAS! <b>THANK YOU!</b></p>  <p><a href="http://www.imperialctc.org/campus-transit-study">http://www.imperialctc.org/campus-transit-study</a></p>		

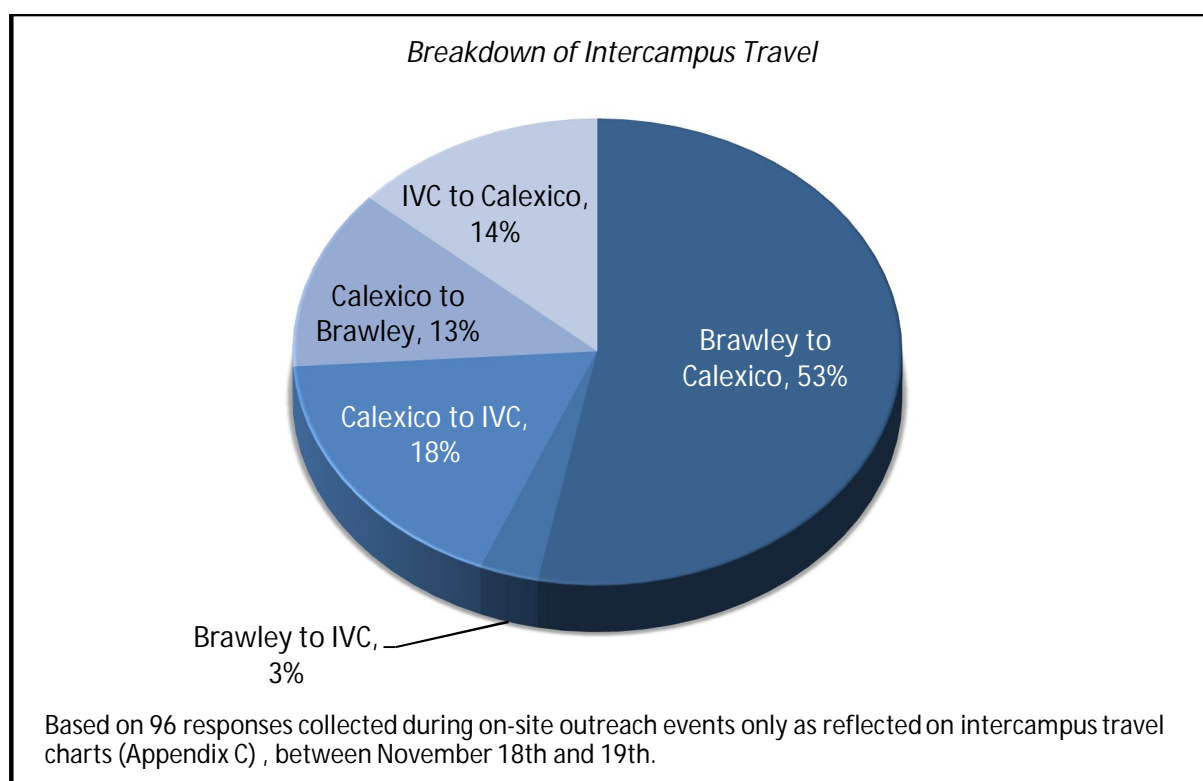
Poster board showing the sticker dot “voting” box (top left), with areas to capture comments about operating hours and frequency (top right) and additional suggestions (bottom left).

## 9.0 OVERVIEW OF PUBLIC INPUT

The public input results gathered during the two rounds of outreach were valuable in shaping and refining the transit route alternatives. Over 400 participants took part in the outreach activities, with over 300 during the first round and over 100 during the second round.

### *First Round of Outreach*

According to the intercampus travel charts, trips starting from SDSU-Brawley and ending at SDSU-Calexico were most common, accounting for roughly 53%, followed by trips between SDSU-Calexico and IVC (roughly one-third) (please see Appendix C for in depth results).



Of the most common intercampus trips documented by participants, travel from SDSU-Brawley to SDSU-Calexico was most frequent during the afternoon (roughly 38% of participants' intercampus trips), followed by IVC to SDSU-Calexico in the afternoon (13%) and SDSU-Brawley to SDSU Calexico in the evening (12%).

Appendix C contains the complete set of results from the questionnaire. The following main trends were revealed:

- Over 90% of questionnaire respondents want bus service between the college campuses.

- Current IV Transit ridership within the sampled college communities is around 19%
- Driving (74%) was identified as the main reason for not taking IV Transit, while bus fares were not viewed as a barrier to taking transit.
- 42% of questionnaire respondents attend two college campuses, while nearly 7% attend all three, collectively comprising a total of 49% of the respondents currently having intercampus commutes.
- Nearly all survey respondents were students (98%), with little participation by instructors and staff.
- 21% of the questionnaire respondents were currently cross-enrolled between SDSU-Imperial Valley and IVC.

*Breakdown of Intercampus Travel by Time of Day*

FROM > TO	Morning	Afternoon	Evening
Brawley > Calexico	4%	38%	11%
Brawley > IVC	0%	2%	1%
Calexico > Brawley	0%	5%	7%
Calexico > IVC	4%	5%	8%
IVC > Brawley	0%	0%	0%
IVC > Calexico	0%	13%	1%

Frequency	
	0% - 5%
	5.01% - 10%
	10.01% +

The following comments on existing service were expressed most frequently, presented in no particular order:

- Personal Barriers to Using Transit
  - The main personal barriers to using transit were based on the need for schedule flexibilities due to work or family obligations before and/or after classes.
  - A few participants noted that increased frequency of buses would sway them to use transit due to cost savings.
- Previous or Future Opportunities for Transit Use]
  - A subset of participants was previously enrolled at multiple campuses, but were now only attending one campus.
  - Likewise, there was a group of participants who wanted to take or were planning on taking courses at other campuses in the near future.
  - Both groups generally indicated support for an intercampus shuttle.
- Transit Dependency
  - The few participants who were completely transit dependent and/or with disabilities specified a strong interest in an intercampus shuttle, with route scheduling centered around course schedules.
- Connecting the SDSU Campuses
  - Participants from SDSU-Calexico and SDSU-Brawley noted an interest in service between the two SDSU campuses. A "direct" SDSU-Calexico and SDSU-Brawley shuttle was also mentioned (with no stop in El Centro).

- Some participants indicated that they would be more likely to cross-enroll between the two SDSU campuses if they were able to rely on a shuttle for intercampus travel.

### *Second Round of Outreach*

Nearly 500 sticker dots were placed on all the boards from the outreach events, amongst a total of 118 participants. The table below provides the percentage breakdowns of participants' votes for preferred service alternatives based on the alternative routes and services that were presented.

Over 50% of the participants were in favor of option A (where IVC serves as a transfer point with buses circulating from SDSU-Brawley to IVC and SDSU-Calexico to IVC). Option C was also highly favorable amongst participants with approximately 27% of the votes. Photos of the response boards are provided in Appendix B.

### *Breakdown of Service Route Preferences based on Participants' Votes*

Campus	A	B	C	D	Participants Per Event
IVC Bus Stop	57.3%	7.3%	21.9%	13.5%	24
IVC Bldg 2700	50.4%	7.2%	31.1%	11.4%	66
SDSU-Brawley Lobby	25.0%	43.8%	18.8%	12.5%	4
SDSU-Calexico Quad	51.0%	19.8%	22.9%	6.3%	24
	51.1%	11.0%	27.1%	10.8%	118

Comments specific to alternative service routes were as follows:

#### **Option A:**

- The level of ideal service frequency suggested by participants widely varied to include 30 minute, 45 minute, and 2 to 3 hour intervals between buses.
- Frequent service every 30 to 45 minutes seemed to align with preferences for flexibility in schedules (based on school and work).

- Service every 2 to 3 hours was based on participants' acknowledgement that there are peak travel times based on classes and passing periods.
- In terms of hours of operation for service, a start time of 8AM and ending time of 7PM for both legs of the route were suggested. The earlier start-time was noted as being particularly helpful for those needing to be at SDSU-Brawley for classes that start at 12:55PM.
- It was noted by several participants that the service provided in Option A could exist with some minor adjustments to current transit routes.

#### Option B:

- The level of ideal service frequency suggested by participants was every hour or every 2 hours, rather than 90 minutes.
- The start times of 10:30AM and noon were suggested by participants since IVUP students have morning classes at SDSU-Calexico.
- Participants noted that including the stop at IVC in Option B would be beneficial since Option B would run past IVC anyway, and the stop would only be about an additional 5 minutes (according to participants' estimates).

#### Option C:

- Service frequency suggestions were recommended for every 2, 2 ½, and 3 hours.
- Extended service hours for later return times ranged between 7PM and 10PM to be on the safe side for those wanting to take late-afternoon classes, attend group meetings, and/or participate in on-campus events at SDSU's main campus in San Diego.

#### Option D:

- Service frequency suggestions were recommended for every 1 or 2 hours.

Participants noted that Options C and D may be expensive to implement and operate, but provides a greatly needed service in the long-run due to the connections between the three college campuses and SDSU in San Diego, and NAU-Yuma.

There was some mentioning of an "SDSU Express" route as being beneficial to students. When asked to elaborate, participants said that an "SDSU Express" route would connect SDSU-Brawley, SDSU-Calexico, and the SDSU main campus, and ideally run every 4 to 5 hours.

Participants were also provided the opportunity to include additional thoughts, concerns, and reflections of existing transit services.

#### Additional Suggestions:

- Interest in student bus passes, at the price of \$5/semester/student
- Better alignment of service hours to match with class start and end times
- Increasing evening service hours between 8PM to 10PM.
- Make sure bus stops have shade structures.

Reflections of Current Services:

- Website is “too confusing” to use for IVC Express.
- Buses running to and from Brawley are usually crowded.
- Route 2 should run every 2 times per hour instead of hourly.



## 10.0 INTRODUCTION TO EXISTING CONDITIONS

Three of the college campuses in the Imperial Valley – Imperial Valley College (IVC) near the City of Imperial, and San Diego State University-Imperial Valley (SDSU-IV) with campuses in both Calexico and Brawley – have decided to pursue the development of a potential shuttle service linking the three facilities.

The IVC campus near the City of Imperial is currently served by several Imperial Valley Transit (IV Transit) routes. The SDSU-IV Calexico campus is not directly served by transit, although several IV Transit routes operate within walking distance. The SDSU-IV Brawley campus is currently unserved by transit.

The purpose of the Campus Transit Study is to recommend transit access improvements to and between the three campuses. These improvements may include creating a new dedicated transit service that serves the colleges and/or leveraging existing bus service.

This study is a collaborative effort between the Imperial County Transportation Commission (ICTC), Imperial Valley College (IVC), San Diego State University – Imperial Valley (SDSU-IV) and the Southern California Association of Governments (SCAG).

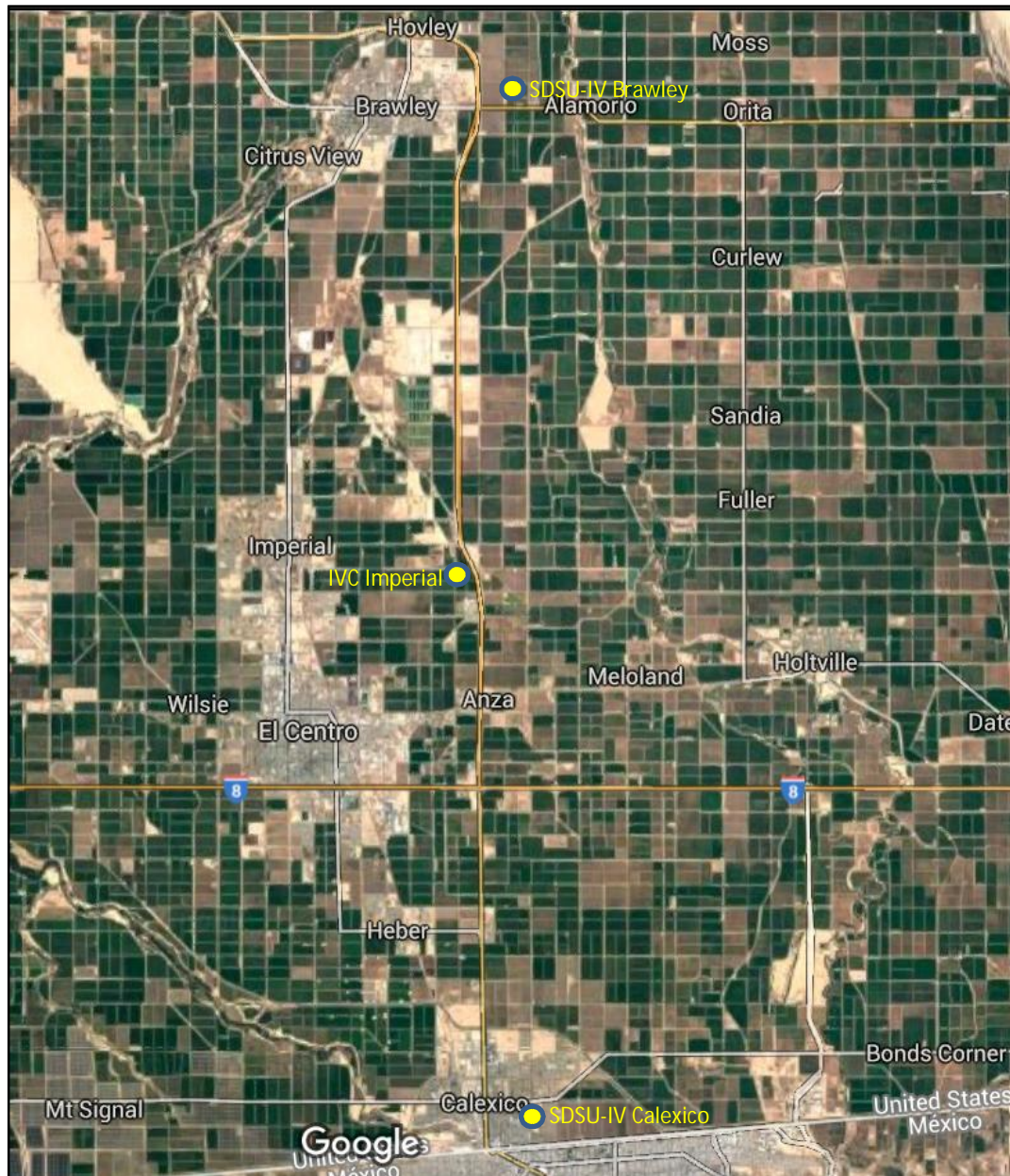
This memorandum describes the overall transit environment in each of the three campuses and includes the following information

- Community overview/population growth trends
- Overview of prior studies conducted
- Review of existing transit services
- Evaluation of needs and opportunities

## 11.0 COMMUNITY OVERVIEW

The study area encompasses the IVC and SDSU-IV campus locations in Imperial, Calexico and Brawley and access routes to and between the campus locations, as shown in Figure 9.

Figure 9: Study Area



Source: Google Imagery/AECOM

IVC is Imperial County's only community college, with its 160-acre main campus located approximately four miles east of the City of Imperial at the intersection of State Highway 111

and Aten Road. In 2011-2012, IVC enrolled around 10,000 students and had around 490 employees<sup>1</sup>.

SDSU-IV's campus site in Calexico is located within walking distance of the IV Transit Terminal and is located in the heart of Calexico's civic center. The SDSU-IV site in Brawley is a small satellite campus, located 24 miles north of Calexico amidst rich agricultural lands, near the intersection of State Highways 111 and 78. In fall 2014, around 950 students were enrolled at the Imperial Valley campuses of San Diego State University – Calexico and Brawley<sup>2</sup>.

The population of Imperial County continues to grow. Table 5 summarizes pertinent *U.S. Census* data for Imperial County and major cities within the county. Of the three cities with college campus locations in the Imperial Valley (Brawley, Calexico and Imperial), the City of Imperial is growing at the fastest rate—99 percent from 2000 to 2010. The city nearly doubled in size between 2000 and 2010, increasing from 7,418 to 14,759 residents. The City of Calexico is currently also experiencing somewhat rapid growth, with a 43 percent increase in population over the last decade. Of the three cities with college campus locations in the Imperial Valley, the City of Brawley is growing at the slowest rate, with a 13 percent increase in population over the last decade.

Table 5: Imperial County and Municipal Growth, 2000-2015

City	2000 Census <sup>1</sup>	2010 Census <sup>1</sup>	Percent Change (2000-2010)	2015 Estimate <sup>2</sup>	Percent Change (2010-2015)
El Centro	37,801	42,598	13%	44,946	6%
Calexico	27,042	38,572	43%	40,092	4%
Brawley	22,096	24,953	13%	26,327	6%
Imperial	7,418	14,758	99%	17,517	19%
Calipatria	7,289	7,705	6%	7,367	-4%
Holtville	5,612	5,939	6%	6,052	2%
Westmorland	2,131	2,225	4%	2,251	1%
Imperial County	142,361	174,528	23%	184,500	6%

Sources: 2000 and 2010 US Census data

<sup>1</sup> 2000 and 2010 US Census data

<sup>2</sup> State of California, Department of Finance, E-5 Population and Housing Estimates for Cities, Counties and the State — January 1, 2011- 2016. Sacramento, California, May 2016. (Accessed at:

<http://www.dof.ca.gov/research/demographic/reports/estimates/e-5/2011-20/view.php>)

<sup>1</sup> Imperial Valley College Fact Book 2011-2012; Accessed at:

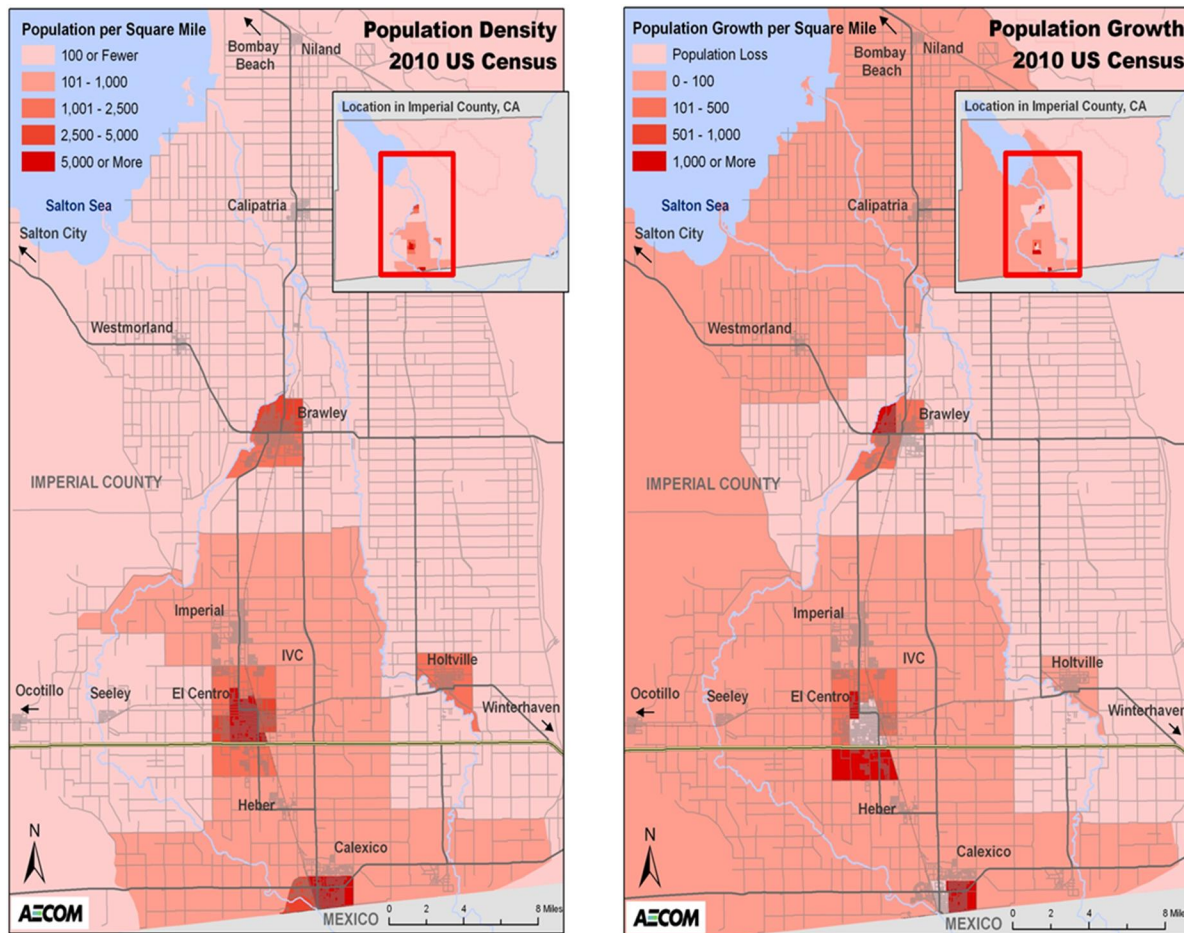
[http://www.imperial.edu/index.php?option=com\\_docman&task=doc\\_view&gid=4087&Itemid=762](http://www.imperial.edu/index.php?option=com_docman&task=doc_view&gid=4087&Itemid=762)

<sup>2</sup> Headcount information, [http://www.ivcampus.sdsu.edu/information/news\\_details.asp?ID=1142](http://www.ivcampus.sdsu.edu/information/news_details.asp?ID=1142)



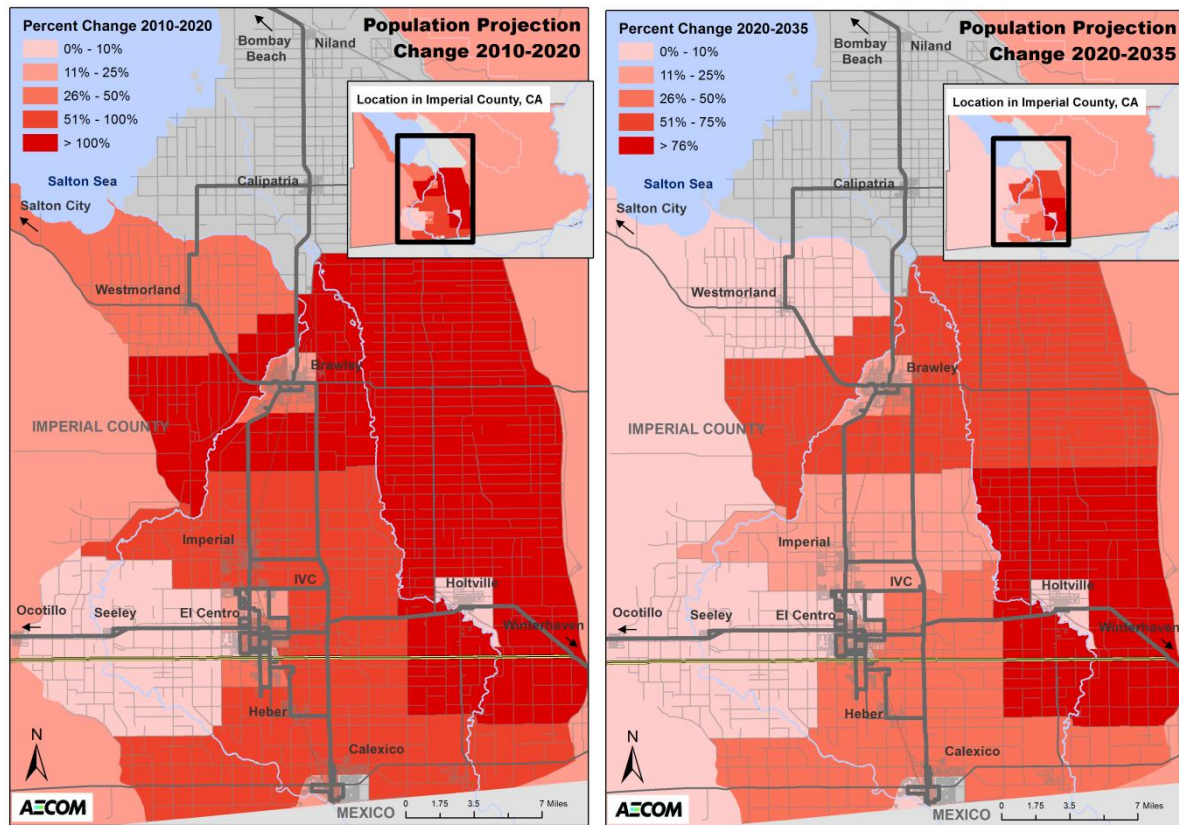
Figure 10 and Figure 11 depict the population growth within Imperial County based on 2010 US Census data and SCAG 2012-2035 RTP/SCS growth forecasts.

Figure 10: Imperial County Population Density and Growth Map (2010 Census)



Source: 2010 US Census data

Figure 11: Imperial County Population Growth Projection Map



Sources: 2010 US Census data

SCAG Regional 2012-2035 RTP/SCS Growth Forecasts, (Adopted April 2012); Accessed at:  
[http://rtpscs.scag.ca.gov/Documents/2012/final/SR/2012fRTP\\_GrowthForecast.pdf](http://rtpscs.scag.ca.gov/Documents/2012/final/SR/2012fRTP_GrowthForecast.pdf)

Comparison of population projections based on data from SCAG Regional 2012-2035 RTP/SCS Growth Forecasts<sup>3</sup>, show that the growth in Imperial County will outpace the growth in SCAG Region as a whole.

Table 6 summarizes 2020 and 2035 population projections for cities within Imperial County and SCAG Region as a whole. Between 2020 and 2035, while the population of SCAG Region as a whole is estimated to grow at a rate of 12 percent, Imperial County is estimated to grow at a rate of 18 percent.

<sup>3</sup> [http://rtpscs.scag.ca.gov/Documents/2012/final/SR/2012fRTP\\_GrowthForecast.pdf](http://rtpscs.scag.ca.gov/Documents/2012/final/SR/2012fRTP_GrowthForecast.pdf)

Table 6: 2020 and 2035 Population Projections

City	2020 Projection	Percent Change (2020-2035)	2035 Projection
El Centro	50,300	22%	61,300
Calexico	50,800	24%	62,800
Brawley	36,200	29%	46,800
Imperial	19,900	15%	22,900
Calipatria	9,000	10%	9,900
Holtville	6,600	11%	7,300
Westmorland	3,000	27%	3,800
Imperial County	244,000	18%	288,000
SCAG REGION	19,663,000	12%	22,091,000

Source: SCAG Regional 2012-2035 RTP/SCS Growth Forecasts, (Adopted April 2012); Accessed at: [http://rtpscs.scag.ca.gov/Documents/2012/final/SR/2012fRTP\\_GrowthForecast.pdf](http://rtpscs.scag.ca.gov/Documents/2012/final/SR/2012fRTP_GrowthForecast.pdf)

Based on the *Imperial Valley College 2009-2013 Strategic Plan*, enrollment at IVC is projected to grow at an average annual rate of approximately 3 percent<sup>4</sup>.

In the aggregate, population both within Imperial County, as well as the student enrollment at both the IVC and SDSU-IV campuses, continues to grow.

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<sup>4</sup> Imperial Valley College 2009-2013 Strategic Plan, Accessed at: [http://www.imperial.edu/index.php?option=com\\_docman&task=doc\\_view&gid=3451&Itemid=762](http://www.imperial.edu/index.php?option=com_docman&task=doc_view&gid=3451&Itemid=762)

## 12.0 PRIOR STUDIES

This section briefly describes prior transit studies completed in Imperial County.

### ICTC Short Range Transit Plan

ICTC completed a regional Short Range Transit Plan (SRTP) in 2012 which recommended improvements to and expansion of the existing route network, as well as the implementation of several new circulator services. The SRTP is a five year plan with implementation outlined to occur in three phases. Based on available funds, following are some of the major initiatives that have been completed so far.

- Route renaming plan
- Introduction of improved trip frequencies on weekdays & Saturdays
- Introduction of Sunday service

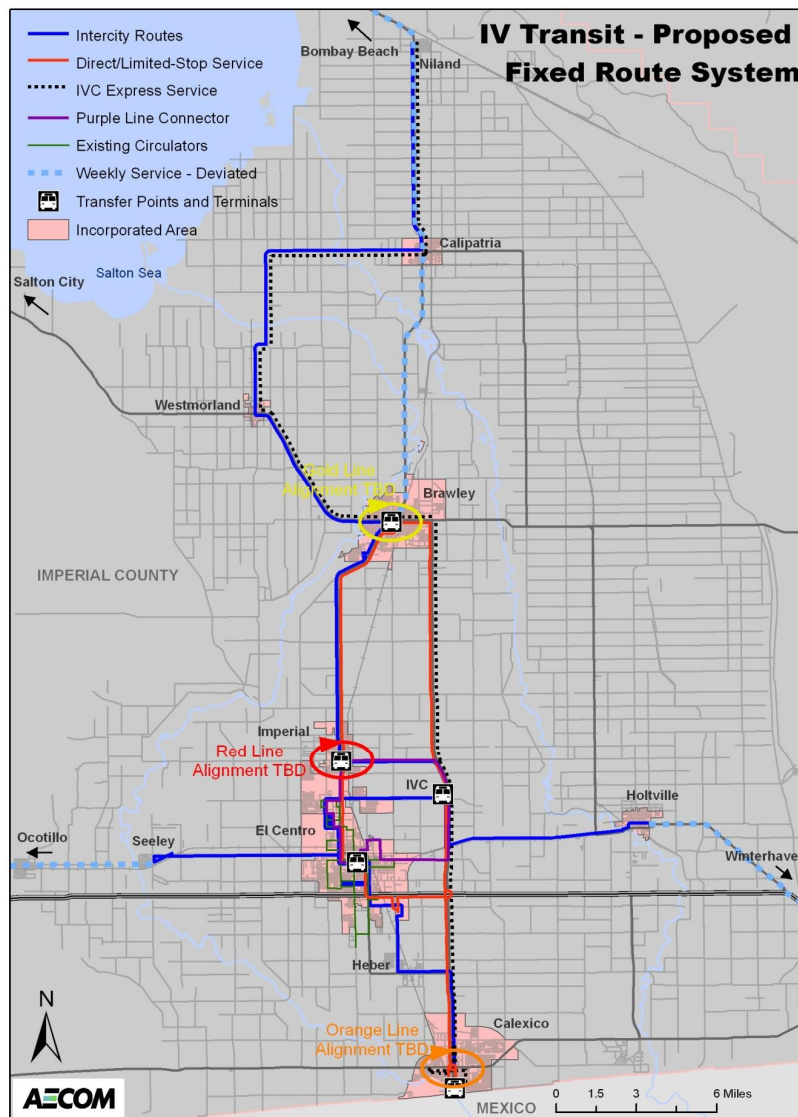
The SRTP identifies improvements to ICTC to better serve students including additional direct bus service on Calexico-IVC route thereby supporting the coordinated academic program between the colleges<sup>5</sup>.

Figure 12 depicts the proposed IV Transit fixed route system based on the 2012 SRTP.

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<sup>5</sup> Page 2-7, The Imperial County Transportation Commission (ICTC) FY 2010-2011 Short Range Transit Plan, 2012

Figure 12: IV Transit Proposed Fixed Route System (2012 SRTP)



Source: AECOM

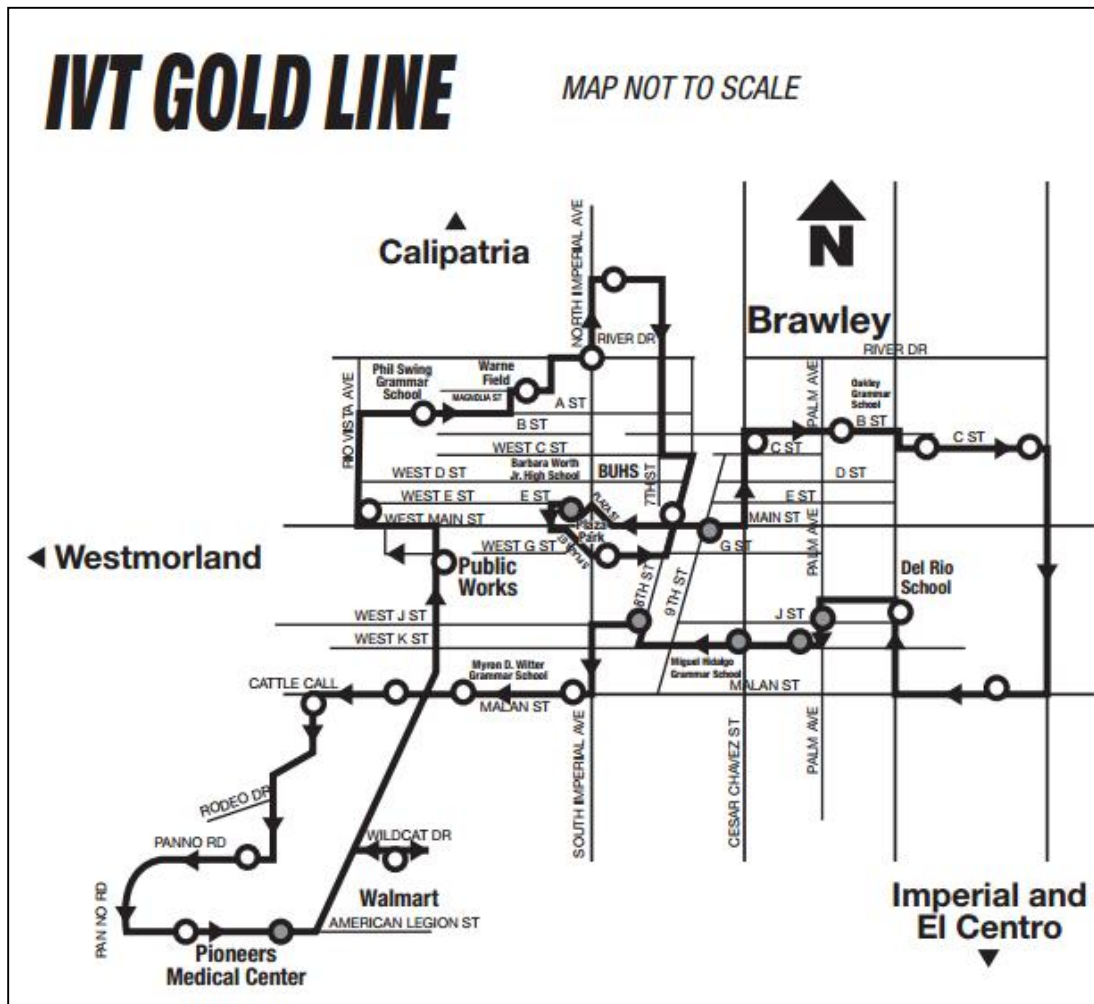
### ICTC Circulator Bus Design Project

The ICTC Circulator Bus Design Project was completed in 2014. The Circulator Bus Design Project aimed to provide riders in Brawley, Imperial, and Calexico with enhanced coverage within each community, as well as efficient connections to the main IV Transit bus routes. IV Transit currently has main routes that provide service between cities in Imperial County.

The three recommended IV Transit circulator shuttle routes include the Gold Line in Brawley, Orange Line in Calexico, and Red Line in Imperial. The Orange Line will be renamed to Garnet Line, based on request from the City of Calexico. The Gold Line in Brawley depicted in Figure 13 has been implemented. Figure 14 and Figure 15 depict the circulator bus route recommendations in Imperial and Calexico.

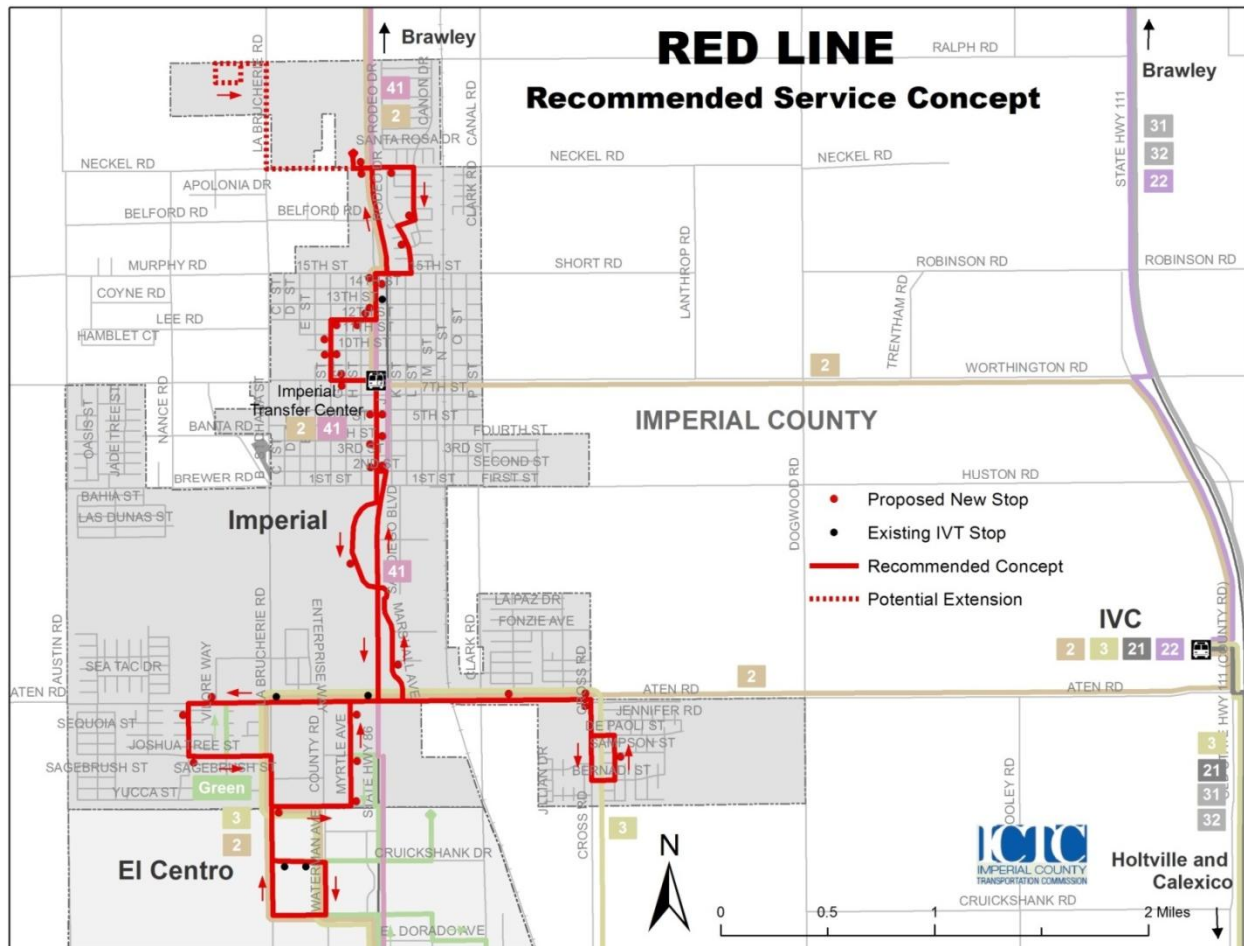


Figure 13: Route Alignment for Gold Line in Brawley



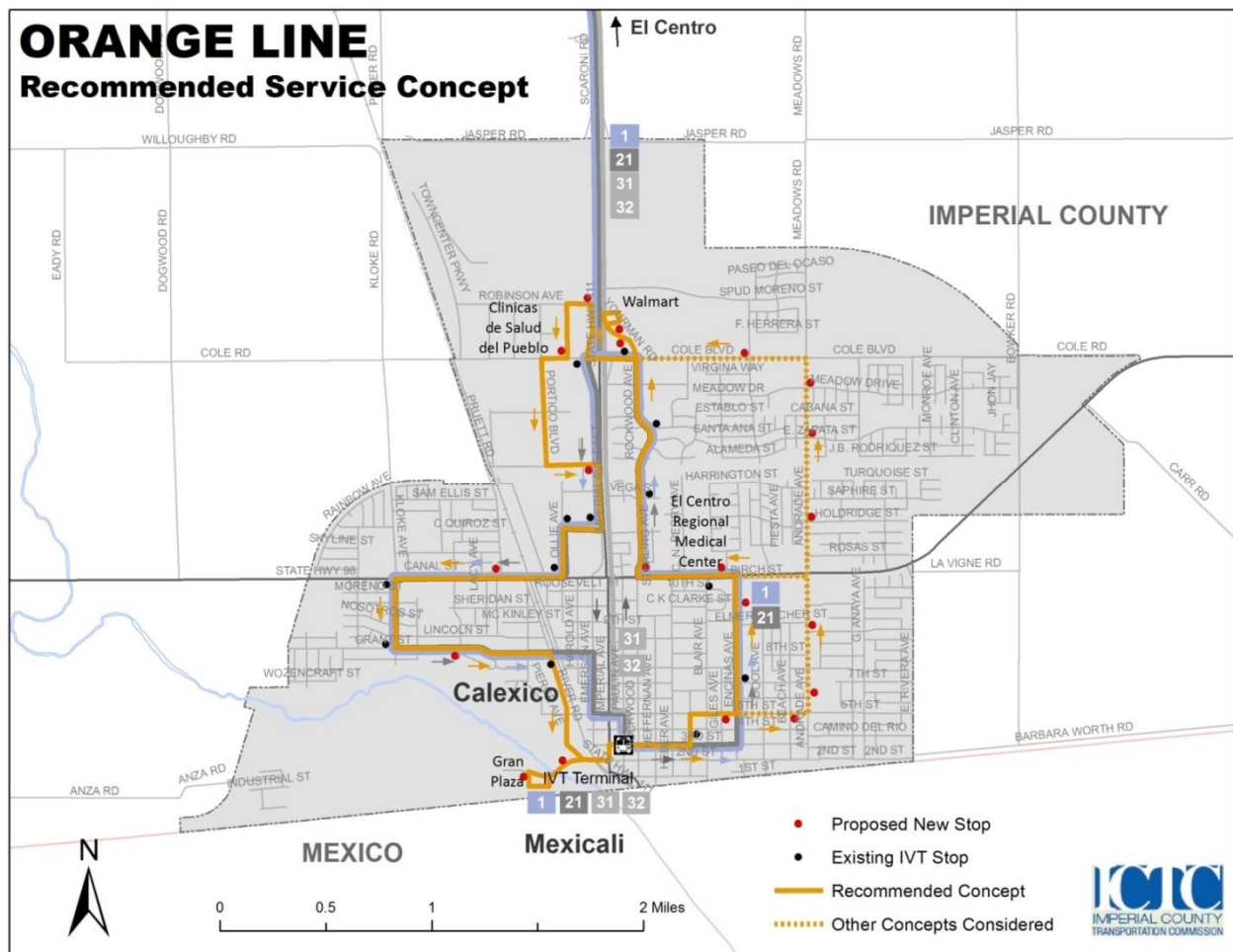
Source: IV Transit

Figure 14: Recommended Service Concept for Red Line in Imperial



Source: AECOM

Figure 15: Recommended Service Concept for Orange Line in Calexico<sup>6</sup>



Source: AECOM

<sup>6</sup> The Orange Line will be renamed to Garnet Line.

## 13.0 REVIEW AND EVALUATION OF EXISTING TRANSIT SERVICES

This section describes the existing transit services to the three college campuses in the Imperial Valley.

### Imperial

The Imperial Valley College (IVC) campus in the city of Imperial is served by several IV Transit Routes. The details and service characteristics of these routes are described below.

- Route 2 El Centro-Niland – Route 2 connects El Centro (14<sup>th</sup> Street and State Street, where transfers are available to other routes) and Niland via IVC, Imperial, Brawley, Westmorland and Calipatria. More trips are operated between El Centro and Brawley than between Brawley and Niland—five northbound and four southbound weekday trips, and four northbound and three southbound Saturday trips operate only between El Centro and the Brawley Transfer Center.
  - Route 2 operates all days of the week
  - Annual ridership in 2015: 256,172
  - Approximate daily ridership in 2015: 1,000 weekdays/285 Saturdays
  - Service frequency to IVC campus
    - Weekdays: approximately every 70 minutes from 6:00AM to 10:00PM
    - Saturdays: approximately every 90 minutes from 6:00AM to 8:00PM
    - Sundays: route operates, but no IVC service
  - Stops in Brawley along Highway 86, K Street, Palm Avenue, Main Street and at the Brawley Transfer Center at E Street and Rio Vista Avenue
- Route 3 El Centro-Holtville – Route 3 connects El Centro with Holtville, located on California State Route 115 to the east of El Centro, via southern Imperial and IVC. Five round trips are available Monday through Friday between Holtville and El Centro, with additional service on Wednesdays to Winterhaven (in the remote zone). Travel is available from Winterhaven to El Centro as part of the first westbound trip of the day, and from El Centro to Winterhaven on the last eastbound trip of the day.
  - Service operates Monday through Saturday
  - Five weekday round trips and two Saturday round trips
  - Annual ridership in 2015: 16,062
  - Approximate daily ridership in 2015: 46 weekdays/16 Saturdays
  - Service frequency to IVC campus
    - Weekdays: Five trips in each direction from 7:30AM to 7:00PM
    - Saturdays: one westbound trip at 7:20AM; two trips in each direction from 2:00PM to 7:00PM
    - Sundays: no service on Route 3
  - Stops in Imperial along LaBrucherie Road, Aten Road and Cross Road and at IVC

- Route 4 El Centro-Seeley/Ocotillo – Route 4 connects Seeley with El Centro via Evan Hewes Highway/Adams Avenue, State Street and IVC, with on demand service on Tuesdays to the Ocotillo Post Office.
  - Service operates Monday through Saturday
  - Annual ridership in 2015: 6,683
  - Approximate daily ridership in 2015: 20 weekdays
  - Service frequency to IVC campus
    - Weekdays: one eastbound trip at 8:00AM
    - Saturdays: route operates, but no IVC service
    - Sundays: no service on Route 4
  - Stops in Seeley (Evan Hewes Highway & Drew Road), El Centro along LaBrucherie Road, State Street and at IVC. On demand service on Tuesdays to the Ocotillo Post Office.

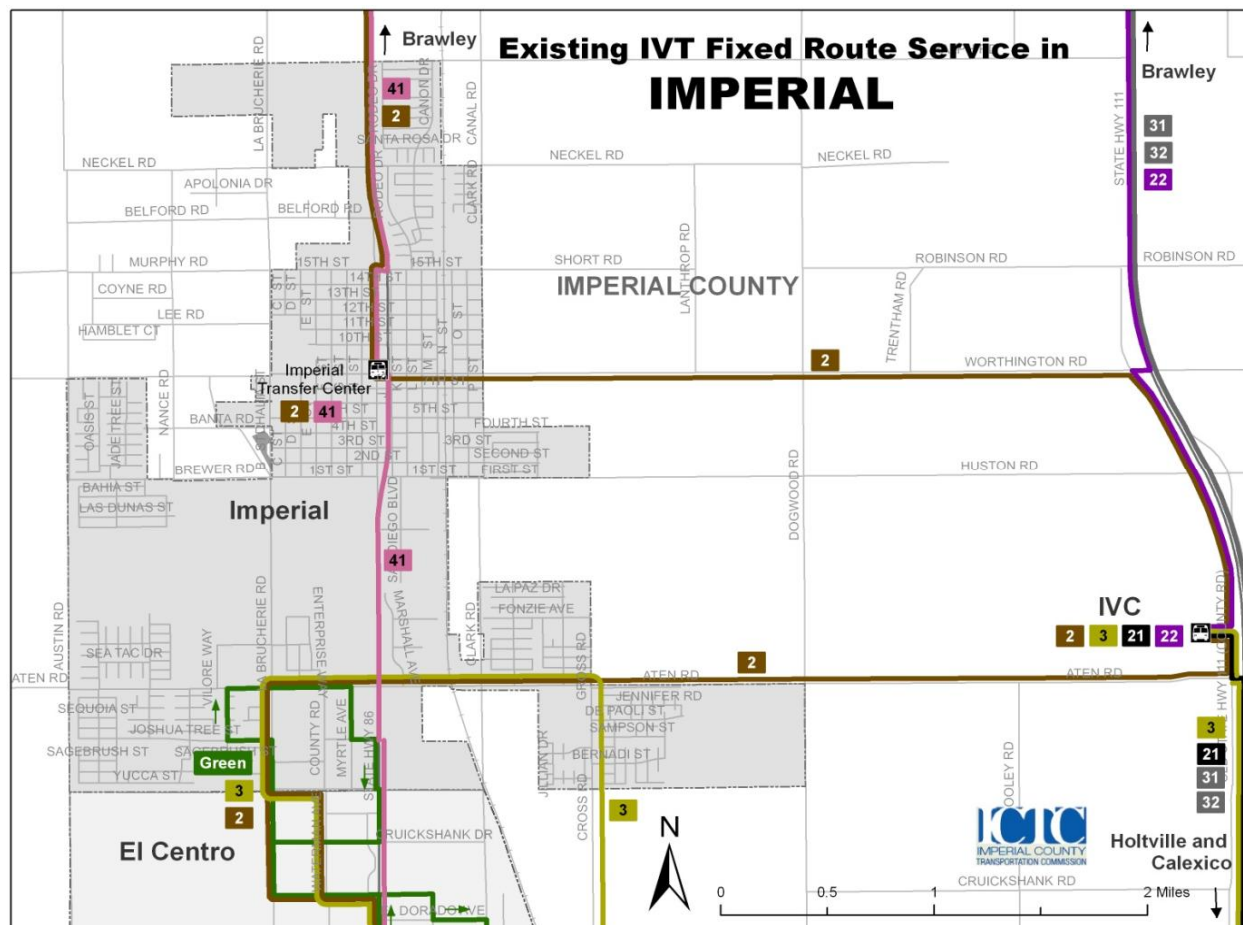
The IVC campus is also served by the two IVC Express Routes:

- Route 21 *IVC Express* – This route directly connects the IVC campus with Calexico, eliminating the need to transfer in El Centro. Route 21 operates on days when IVC is in session, and charges a premium fare. The route operates a similar loop at its southern end as IV Transit’s Route 1, allowing for the pickup and distribution of passengers throughout Calexico.
  - Service operates on IVC school days only
  - Annual ridership in 2015: 73,435
  - Approximate daily ridership in 2015: 500
  - Service frequency to IVC campus
    - Mondays-Thursdays when IVC is in session:
      - Six morning trips from Calexico from 7:00AM to 9:45AM
      - Five afternoon trips to Calexico from 12:30PM to 5:30PM
    - Fridays when IVC is in session:
      - Three morning trips from Calexico from 7:15AM to 9:45AM
      - Three afternoon trips to Calexico from 12:30PM to 3:30PM
    - Saturdays and Sundays: no service on Route 21 *IVC Express*
  - Stops in Calexico along the same loop served by Route 1, including the IV Transit Terminal at Third Street and Paulin Avenue
- Route 22 *IVC Express* – This route provides service to IVC from areas in the north, including Niland, Calipatria, Westmorland and Brawley on days when class is in session.
  - Service operates IVC school days only
  - Annual ridership in 2015: 7,837
  - Approximate daily ridership in 2015: 44
  - Service frequency to IVC campus
    - Weekdays when IVC is in session:
      - Two morning trips from Niland at 7:30AM and 9:50AM

- Two afternoon trips to Niland from 2:00PM to 4:00PM
- Saturdays and Sundays: no service on Route 22 *IVC Express*
- Stops at IVC campus

Figure 16 depicts the existing IV Transit fixed route service in the City of Imperial and at IVC.

Figure 16: Existing IV Transit Fixed Route Service in Imperial



Source: AECOM



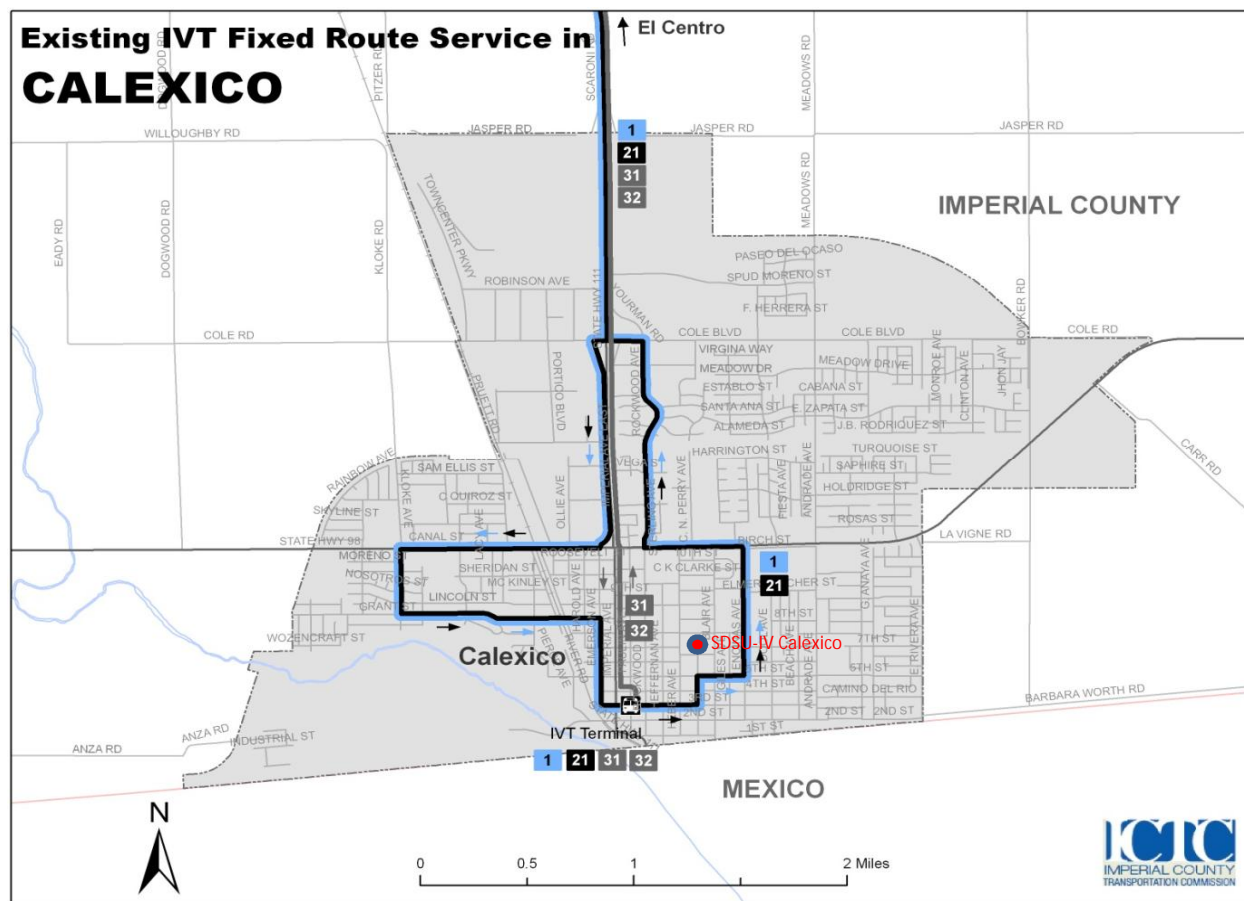
## Calexico

The SDSU-IV campus in Calexico is served by some IV Transit stopping nearby within walking distance at East 7<sup>th</sup> Street and Encinas Avenue:

- Route 1 Calexico-El Centro – Route 1 connects El Centro with Calexico, serving Heber and the Imperial Valley Mall in between these points. This route is the busiest in the system, accounting for approximately 49 percent of total boardings, with some northbound trips exceeding 70 passengers. Southbound service operates from downtown El Centro to downtown Calexico roughly via California State Route 86 and 4<sup>th</sup> Street, Danenberg Road, Dogwood Road, Heber Avenue and California State Route 111. Northbound trips operate a loop through Calexico, then retrace the southbound route back to El Centro.
  - Service operates all days of the week
  - Annual ridership in 2015: 288,098
  - Approximate daily ridership in 2015: 1,061 weekdays/369 Saturdays
  - Service frequency to SDSU-IV Calexico campus
    - Weekdays when IVC is in session: approximately every 35 minutes from 5:45AM to 11:00PM
    - Weekdays when IVC is not in session: approximately every 35 minutes from 5:45AM to 7:45PM
    - Saturdays: approximately every 70-90 minutes from 6:00AM to 7:15PM
    - Sundays: Four to six trips from 7:00AM to 4:45PM
  - Stops in Calexico along Scaroni Road, Birch Street, Kloke Road, Grant Street, Emerson Avenue, Third Street, Mary Avenue, Fifth Street, Encinas Avenue, Birch Street and Rockwood Avenue, including the IV Transit Terminal at Third Street and Paulin Avenue

Figure 17 depicts the existing IV Transit fixed route service in Calexico.

Figure 17: Existing IV Transit Fixed Route Service in Calexico



Source: AECOM

The SDSU-IV campus in Calexico is also near one *IVC Express* route which is the only “one-seat ride” today between the Imperial and Calexico campuses. As described previously, Route 21 *IVC Express* directly connects the IVC campus with Calexico, eliminating the need to transfer in El Centro. Figure 18 depicts the route alignment for this service.

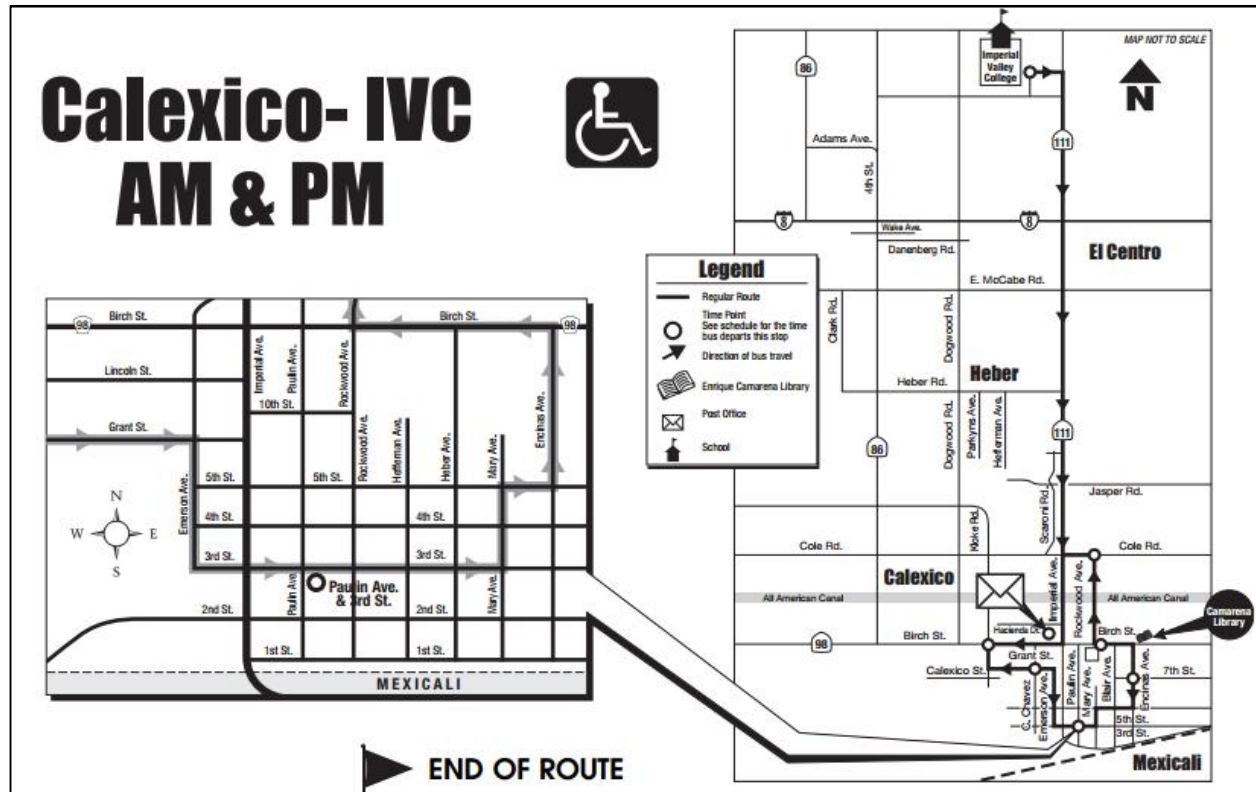
Service characteristics for Route 21 *IVC Express* are as follows:

- Service operates on IVC school days only
- Annual ridership in 2015: 73,435
- Approximate daily ridership in 2015: 500
- Service frequency to IVC campus
  - Mondays-Thursdays when IVC is in session:
    - Six morning trips from Calexico from 7:00AM to 9:45AM
    - Five afternoon trips to Calexico from 12:30PM to 5:30PM
  - Fridays when IVC is in session:
    - Three morning trips from Calexico from 7:15AM to 9:45AM
    - Three afternoon trips to Calexico from 12:30PM to 3:30PM
  - Saturdays and Sundays: no service on Route 21 *IVC Express*



- Stops in Calexico along the same loop served by Route 1, including the IV Transit Terminal at Third Street and Paulin Avenue

Figure 18: IVC Express “One-Seat” Ride Between IVC and Calexico

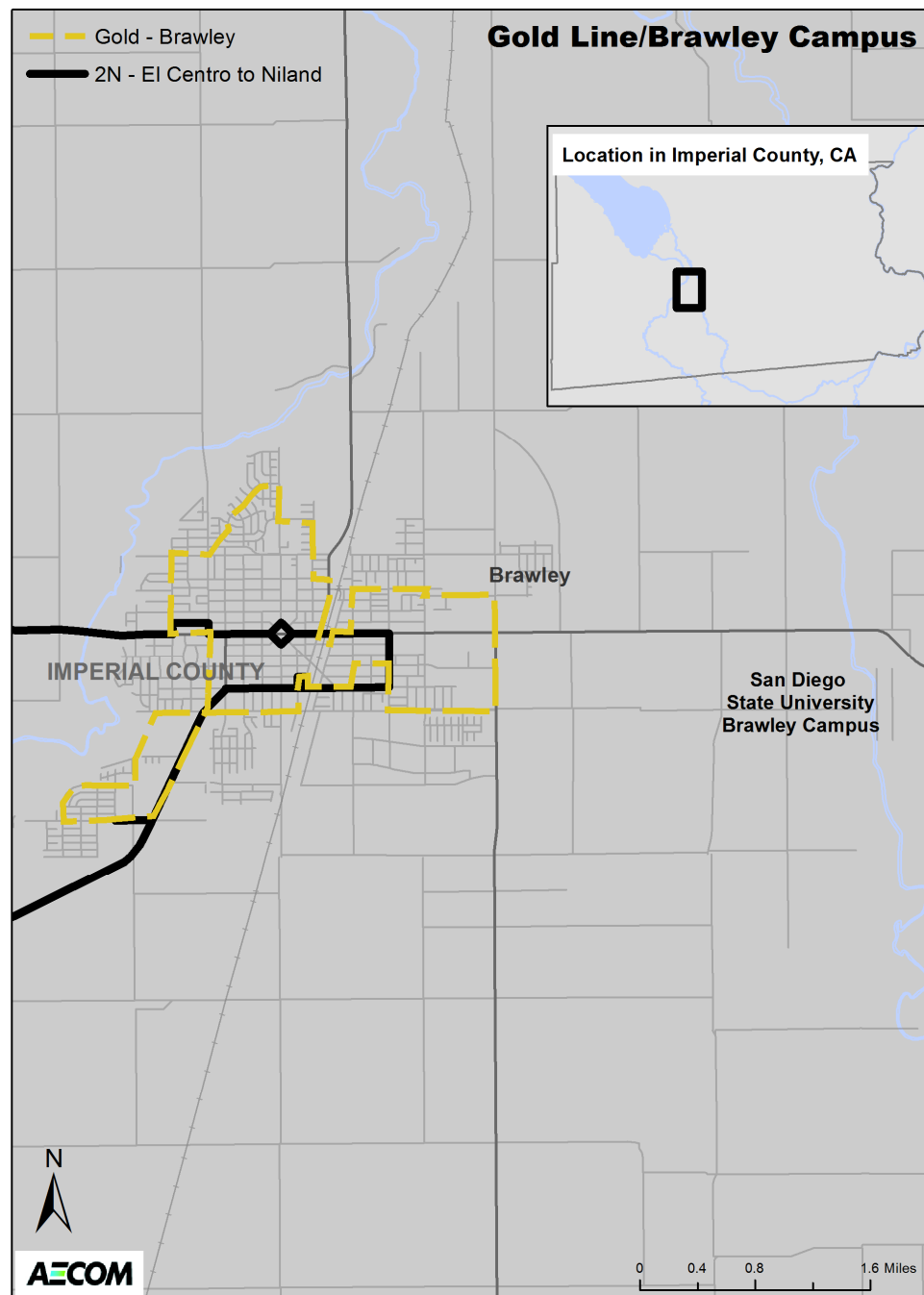


Source: IV Transit/ICTC

## Brawley

The SDSU-IV campus in Brawley is located east of California State Route 111 (as shown in Figure 19) and is currently unserved by fixed route public transit.

Figure 19: Existing IV Transit Fixed Route Service in Brawley



Source: AECOM

## Evaluation Summary

Overall, the existing IV Transit service is primarily oriented towards connecting the urban centers in the Imperial Valley with each other; however, the academically-oriented services that are operated by IV Transit are oriented around Imperial Valley College (IVC), and less so towards San Diego State University (SDSU).

In addition, the only existing connection amongst the three study campuses that can be made with no transfers is between the SDSU-IV Calexico campus and IVC via the Route 21 *IVC Express*.

Finally, it should again be noted that the SDSU-IV Brawley campus is located in a relatively remote area east of Brawley, and – at the present time – there is no fixed route transit service available to that location.

## 14.0 EVALUATION OF NEEDS AND OPPORTUNITIES

As was previously mentioned, the IVC campus near the City of Imperial is currently served by several IV Transit routes. The SDSU-IV Calexico campus is not directly served by transit, although it is within walking distance of several bus stops, including the IV Transit Terminal. Finally, the SDSU-IV Brawley campus is unserved by transit.

The following is a summary evaluation of the potential needs and opportunities for an improved transit shuttle service between the three campus locations in the Imperial Valley.

### Potential Need

The need (and potential market) for a shuttle service connecting the three campus locations is best defined by several concurrent issues:

- Approximately 34 to 36 percent of the population in the cities of Imperial, Brawley and Calexico is comprised of youth population (under the age of 20)<sup>7</sup>.
- Approximately 12 to 15 percent of the population in the City of Brawley and Calexico is comprised of zero-car households<sup>8</sup>.
- A high percentage of riders on the existing IV Transit routes are students and, as such, there is a perceived need for inter-campus transit service between the three campus locations in the Imperial Valley.
- Based on passenger surveys conducted during the public outreach activities for the study, majority (53%) of current intercampus trips start at SDSU-Brawley campus and end at SDSU-Calexico campus. Trips starting at SDSU-Calexico campus and ending at IVC campus, account to about 14% of the current intercampus travel<sup>9</sup>.
- Of the most common intercampus trips documented by survey participants, travel from SDSU-Brawley to SDSU-Calexico is most frequent in the afternoons (38%). This is followed by travel from IVC to SDSU-Calexico in the afternoons (13%) and travel from SDSU-Brawley to SDSU Calexico in the evenings (12%)<sup>10</sup>.
- 42% of the passenger survey respondents attended two college campuses, while nearly 7% attended all three campuses. Collectively, 49% of the survey respondents currently make intercampus trips<sup>11</sup>.
- All three academic institutions have indicated that they are growing, with the additional potential for some level of growth in programs such as the Imperial Valley University Partnership (IVUP), which may potentially require some inter-campus travel.

<sup>7</sup> U.S. Census Data, 2010-2014 American Community Survey 5-Year Estimates

<sup>8</sup> U.S. Census Data, 2005-2009

<sup>9</sup> Imperial Valley College/San Diego State University Transit Study, Initial Public Outreach Summary, Fall 2015, Page 7

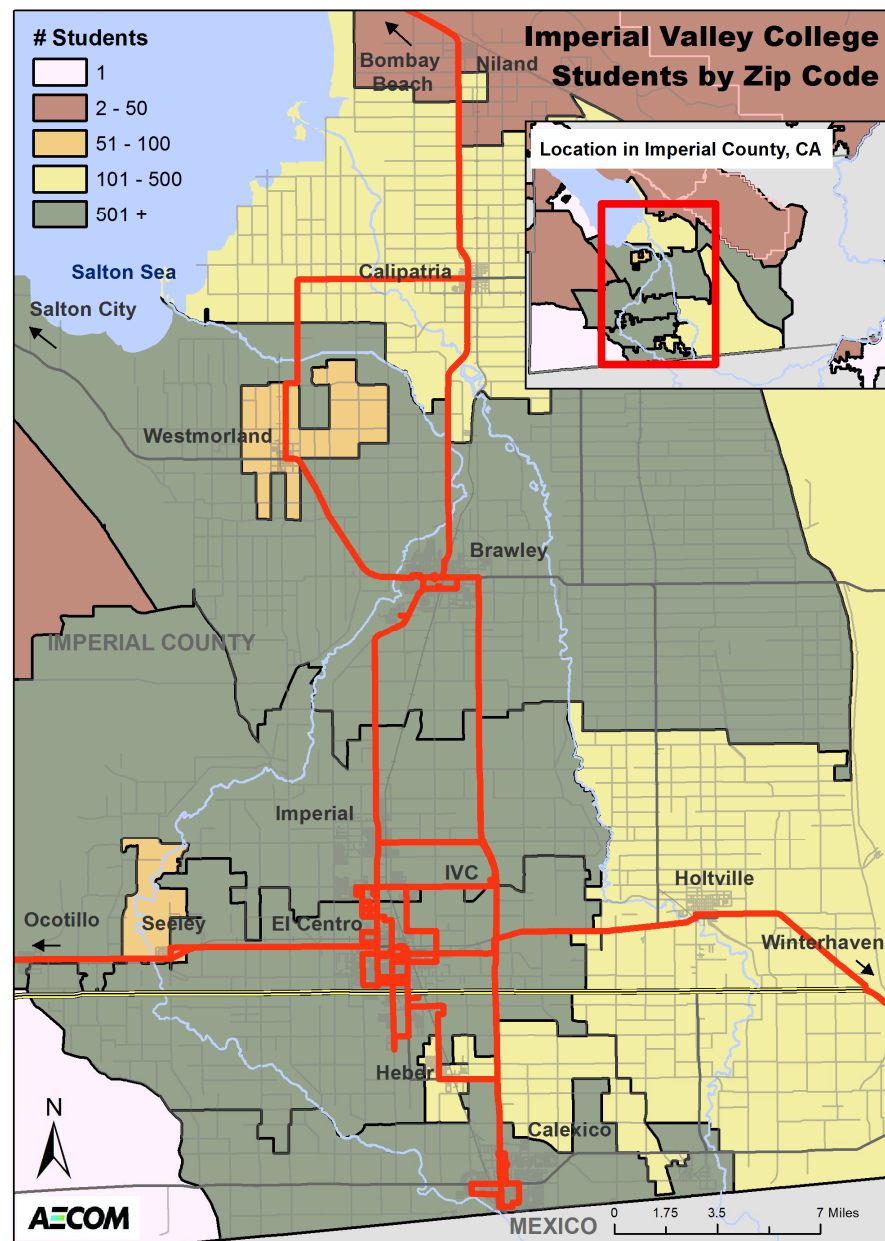
<sup>10</sup> Ibid.

<sup>11</sup> Ibid., Page 8

- Public Outreach participants from SDSU-Calexico and SDSU-Brawley indicated that they would benefit from transit service between SDSU-Calexico campus and SDSU-Brawley campus, preferably a shuttle service with no stop in El Centro. With the presence of transit service, students would be more likely to cross-enroll between the two SDSU campuses.

Figure 20 depicts IVC student's residences by ZIP code. Majority of IVC students reside in the areas of Imperial, El Centro, Brawley, Westmoreland and Heber.

Figure 20: Location of SDSU-IV Brawley Campus Student Residences



Source: AECOM

Several of the potential scenarios regarding how the potential need is perceived by the academic community are further explored in the outreach process, and summarized in the technical memorandum describing that process and its results.

### Potential Opportunities

Opportunities for transit service improvements between the three college campuses include:

- Creating a completely new transit shuttle service that serves the colleges, with the branding (and fare policy) considerations for the new shuttle services that would accompany such an option; or
- Potentially leveraging the existing IV Transit routes and modifying some of the existing services to enhance transit connections between the college campuses.
- Furthermore, consideration could also be given to the use of alternative fuel/propulsion technologies on any vehicle providing these services.

These opportunities were further explored as part of this study's service planning process.

## 15.0 INTRODUCTION TO DEVELOPMENT OF ROUTE ALTERNATIVES

Three of the college campuses in the Imperial Valley – Imperial Valley College (IVC), near the City of Imperial, and San Diego State University-Imperial Valley (SDSU-IV), with campuses in both Calexico and Brawley – are part of a study team jointly led by the Imperial County Transportation Commission (ICTC) and the Southern California Association of Governments (SCAG) which was awarded a planning grant in early 2015 to pursue the development of a potential shuttle service linking the three facilities.

The IVC campus near the City of Imperial is currently served by several Imperial Valley Transit (IV Transit) routes. The SDSU-IV Calexico campus is not directly served by transit, although several IV Transit routes operate within walking distance. The SDSU-IV Brawley campus is currently unserved by transit.

The purpose of the Campus Transit Study is to recommend transit service and access improvements between the three campuses. These improvements may include creating a new dedicated transit service that serves the colleges as well as leveraging existing bus service.

This study is a collaborative effort between IVC and SDSU-IV – and their collaborative Imperial Valley University Partnership (IVUP) program – and ICTC and SCAG.

This memorandum describes the development of the various route and service alternatives that could serve as a new shuttle bus route between these campuses.

## 16.0 DEVELOPMENT OF ALTERNATIVES

### 16.1– Definition of Route Alternatives

Several transit options were developed during the course of the study that could provide shuttle service between the San Diego State University – Imperial Valley (SDSU-IV) campuses in Calexico and Brawley and the Imperial Valley College (IVC) campus near Imperial.

Many of these alternatives were developed in concert with – and were informed by – the public outreach process, with the outreach process being utilized to screen alternatives and to help determine the Recommended Plan, as described in a subsequent section of this report.

At the outset of the study, it was immediately determined that State Route 111 clearly formed the most logical and direct connection amongst the three campuses and that therefore a shuttle link between the campuses would most likely need to utilize this roadway alignment.

Several route alignment options were developed that would connect the three campuses, and some of these options were modified as the study progressed.

The basic service concepts that were developed are as follows:

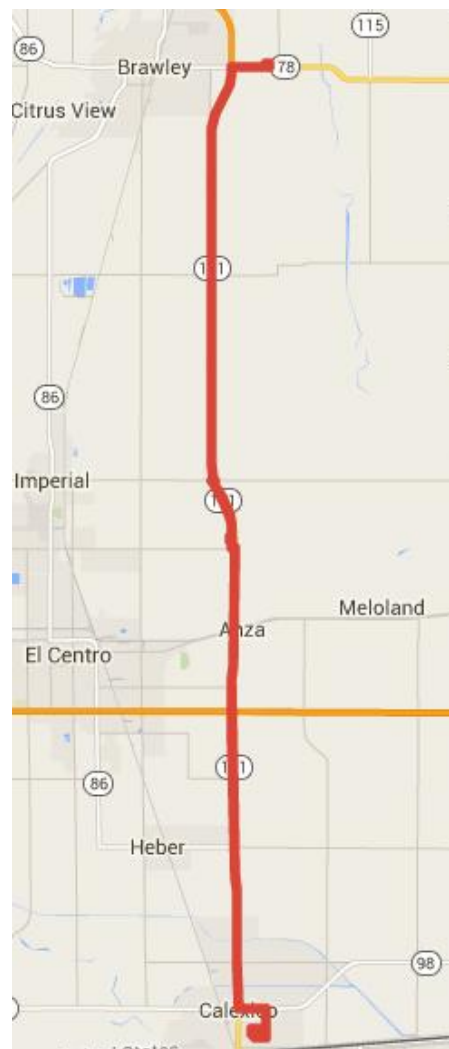
- Single Route – With this concept, a single bus route would serve all three campuses, as shown in Figure 21. The shuttle route would operate primarily along State Route 111, and in this concept the shuttle route would serve three stops at each of the educational institutions.

It is estimated that the cycle time required for this shuttle route concept (i.e., the time required to operate a full round trip, along with dwell time at bus stops and layover/recovery time) is approximately 90 minutes.

This concept served as the basis for the various subsequent service and alignment concepts that were developed. However, it should be noted that this concept – although relatively straightforward – was not advanced further beyond this initial conceptual stage, as its nature would not allow for the “tailoring” of service levels between the various campuses. Due to this significant drawback, the single route option was not utilized any further throughout the planning process.



Figure 21 – Single Shuttle Route Concept

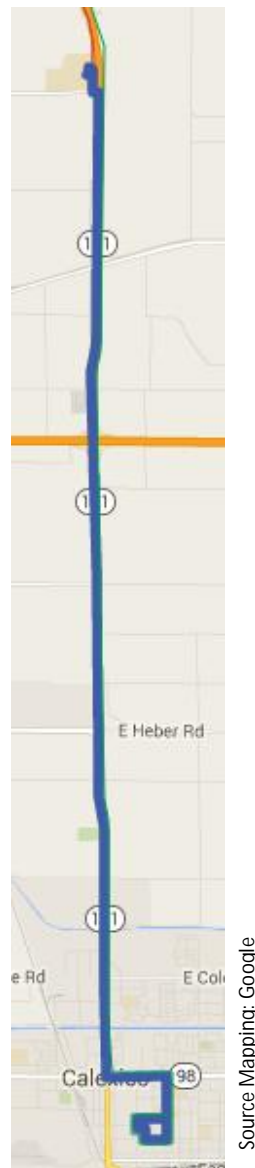


Source Mapping: Google

- IVC Transfer Concept – With this concept, instead of a single shuttle route, there are two shuttle routes: one connecting IVC with SDSU-Calexico and another connecting IVC with SDSU-Brawley. This therefore makes the IVC campus – which is located between the two SDSU campuses – a “hub” and a transfer center for those wishing to travel between the two SDSU campuses. Each shuttle route would have two stops and serve only the IVC campus and either the SDSU-Calexico or SDSU-Brawley campus.

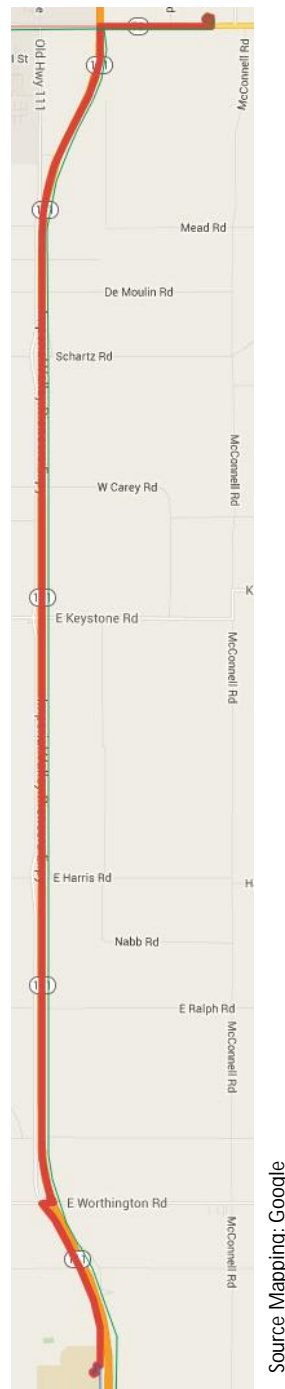
The route between IVC and the SDSU-Calexico campus, as shown in Figure 22, is estimated to require a cycle time of approximately 60 minutes and would operate primarily along State Route 111.

Figure 22 – IVC/SDSU-Calexico Shuttle Route



The route between IVC and the SDSU-Brawley campus, as shown in Figure 23, is estimated to require a cycle time of approximately 40 minutes and would also operate primarily along State Route 111.

Figure 23 – IVC/SDSU-Brawley Shuttle Route



- SDSU Express Route – Another alternative that was developed is the SDSU Express shuttle route concept. With this concept, the shuttle route would only have two stops and operate an “express” service primarily via State Route 111 between the SDSU-Calexico and SDSU-Brawley campuses, bypassing the IVC campus.

This route, as shown in Figure 24, is estimated to require a cycle time of approximately 75 minutes.

Figure 24 – SDSU Express Route



After the initial round of public input and stakeholder outreach, the route between SDSU-Brawley and IVC and the SDSU Express Route proposals were modified, and three additional service concepts were also developed. These are as follows:

- SDSU-Brawley/IVC Shuttle Route – The SDSU Brawley campus is presently unserved by any IV Transit services. Therefore, in order to allow for better connection opportunities with the IV Transit system, the shuttle route proposal between the SDSU-Brawley campus and the IVC campus will also serve the South Plaza transit center in Brawley.

This route will therefore have three stops – at IVC, SDSU-Brawley and at the South Plaza transit center in Brawley. The route between IVC and the SDSU-Brawley campus, as shown in Figure 25, is estimated to require a cycle time of approximately 60 minutes and would also operate primarily along State Route 111.

Figure 25 – Revised IVC/SDSU-Brawley Shuttle Route



Source Mapping: Google

- SDSU Express Route – As with the IVC/SDSU-Brawley Shuttle proposal, this route proposal was also modified to serve the South Plaza transit center in Brawley, in order to allow for better connection opportunities with the IV Transit system.

This route will therefore have three stops – at SDSU-Calexico, SDSU-Brawley and at the South Plaza transit center in Brawley. The route between SDSU-Calexico and the SDSU-Brawley campus, as shown in Figure 26, is estimated to require a cycle time of approximately 90 minutes and would also operate primarily along State Route 111.

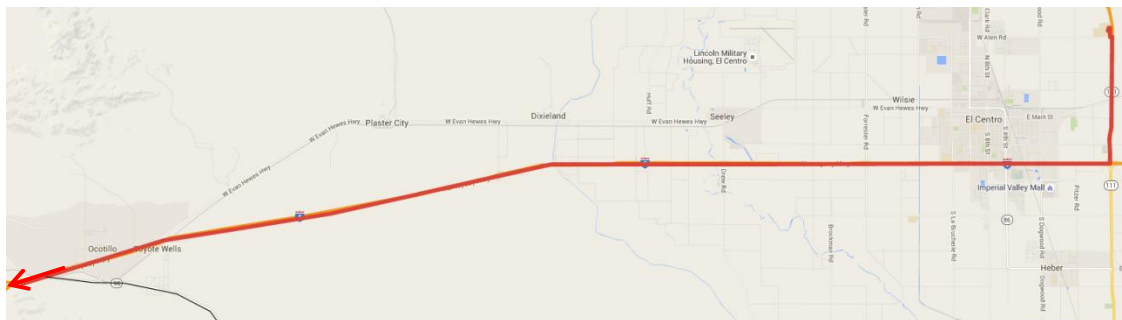
Figure 26 – Revised SDSU Express Route



- San Diego State University Main Campus – Another service option which was developed after the initial round of stakeholder outreach and public input provides service to the SDSU Main Campus in San Diego. This service would either operate from the IVC campus (which would require passengers traveling to and from the SDSU-Calexico campus to first travel to and from the IVC campus) or from the SDSU-Calexico campus itself.

If service were to operate between the SDSU Main Campus and the IVC campus, the route would have two stops – at the IVC campus and at the SDSU Main Campus. The route between SDSU Main Campus and the IVC campus, as shown in Figure 27, is estimated to require a cycle time of approximately 270 minutes (i.e., 4.5 hours) and would operate primarily along Interstate 8.

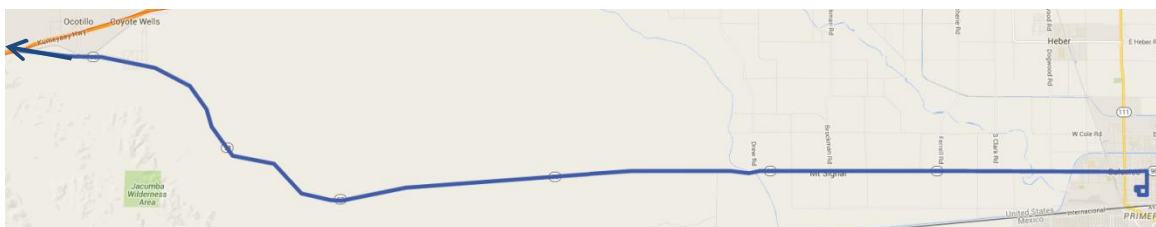
Figure 27 – IVC/SDSU Main Campus Route



Source Mapping: Google

Alternatively, if service were to operate between the SDSU Main Campus and the SDSU-Calexico campus, the route would also have two stops – at the SDSU-Calexico campus and at the SDSU Main Campus. The route between SDSU Main Campus and the SDSU-Calexico campus, as shown in Figure 28, is estimated to require a cycle time of approximately 285 minutes (i.e., 4 hours and 45 minutes) and would operate primarily along State Route 98 and Interstate 8.

Figure 28 – SDSU-Calexico/SDSU Main Campus Route

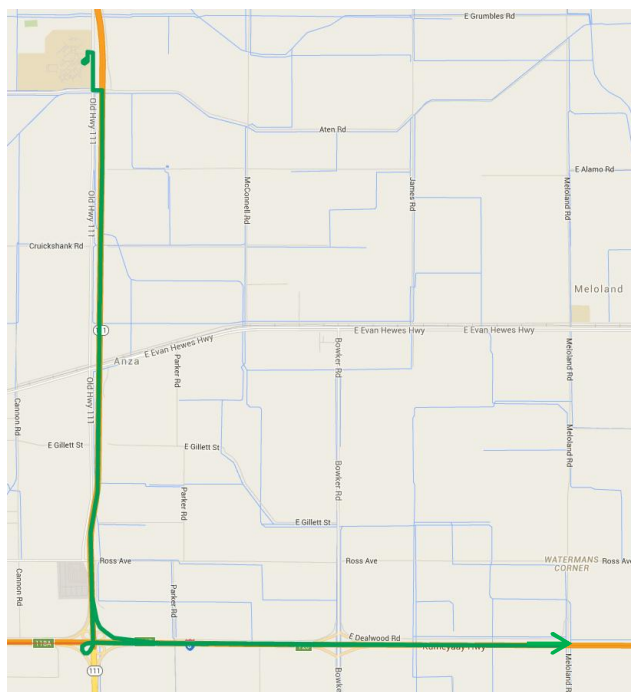


Source Mapping: Google

- Northern Arizona University Yuma Campus – Another service option which was developed after the initial round of stakeholder outreach and public input provides service to the Northern Arizona University (NAU) Yuma Campus in Yuma, Arizona. This service would operate to and from the IVC campus.

If service were to operate between the NAU Yuma Campus and the IVC campus, the route would have two stops – at the IVC campus and at the NAU Yuma Campus. The route between the NAU Yuma Campus and the IVC campus, as shown in Figure 29, is estimated to require a cycle time of approximately 180 minutes (i.e., 3 hours) and would operate primarily along Interstate 8.

Figure 29 – IVC/NAU Yuma Campus Route



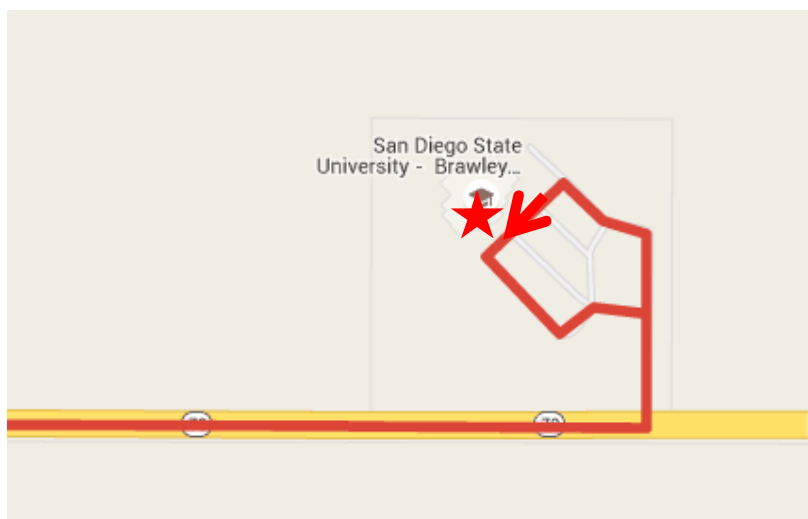
Source Mapping: Google

## 16.2 – Definition of Infrastructure Options – Bus Stop Locations

In addition to utilizing the existing bus stops at the IVC campus and at the South Plaza transit center in Brawley, the proposed shuttle service alternatives would also need new stops at the SDSU-Brawley and SDSU-Calexico campuses.

At the SDSU-Brawley campus, the new bus stop would be located along the front of the classroom building (i.e., the sole campus building), as indicated by the star shown in Figure 30.

Figure 30 – New SDSU-Brawley Bus Stop Location

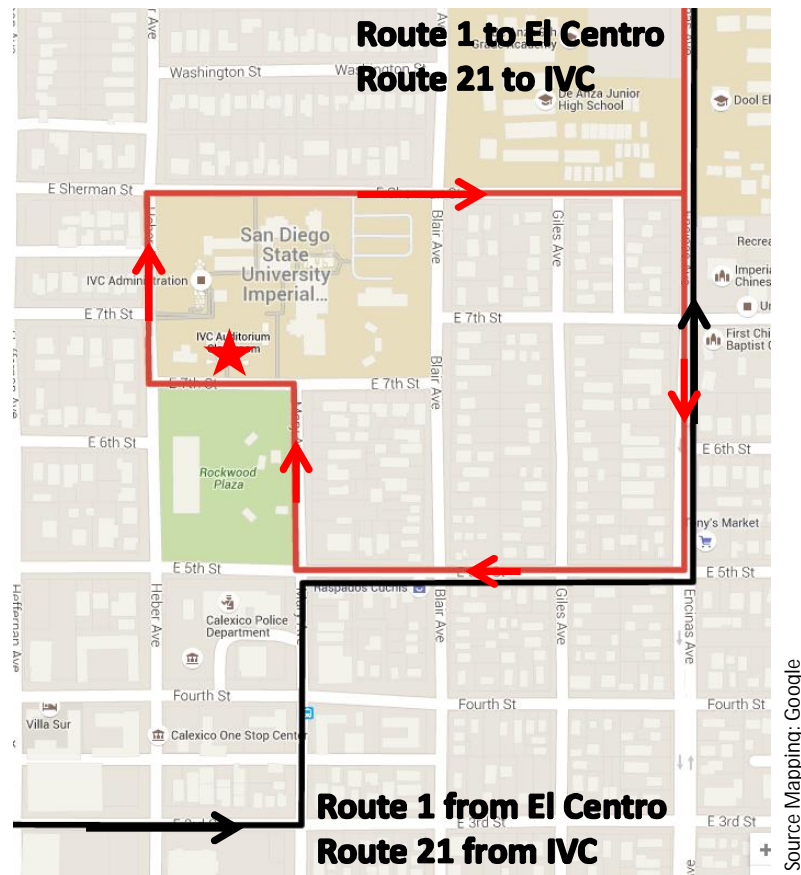


Source Mapping: Google



As was previously mentioned in the Existing Conditions section of the report, the SDSU-Calexico campus is not directly served by the IV Transit system; however, several IV Transit routes are within walking distance. At the SDSU-Calexico campus, the new bus stop would be located along East 7<sup>th</sup> Street at the “main entrance” to the campus, as indicated by the star shown in Figure 31. Also shown are the existing IV Transit routes in the area.

Figure 31 – New SDSU-Calexico Bus Stop Location



It is assumed that each of the new bus stops would be equipped with a passenger waiting shelter as well as benches. The appropriate signage and trash containers will also be provided. It assumed – for the planning purposes of this study – that SDSU will maintain the two new bus stops, as they will be directly serving its facilities.

### 16.3 – Development of Alternative Service Levels

The various route alternatives described previously were presented during both rounds of the public input and stakeholder outreach process with varying levels of service. As was mentioned previously, the “Single Shuttle Route” concept was not advanced beyond the initial concept stage, and the various options serving the SDSU-Brawley campus were all modified so as to also serve the South Plaza transit center.

- Assumptions Utilized – As part of the development of the alternative service levels, several assumptions were required to be utilized. These are as follows:
  - For planning purposes, it was assumed that any shuttle services oriented to the academic community would operate for 201 days per year. This was based on the current IVC Express service provided by IV Transit.
  - The estimated costs of these service alternatives were all calculated consistently amongst the alternatives utilizing the projected revenue hours of service.
  - In order to develop the estimated range of potential annual operating costs, and given the projected revenue hours of service for each option, the revenue hours were multiplied by the following costs per hour (all in current dollars); these costs are based on current IV Transit contractual operating cost rates:
    - \$117.57/hour for potential standard transit bus cost
    - \$86.25/hour for potential “cutaway” bus cost
    - \$77.63/hour for vans (based on 90% of cost for “cutaway” buses)These vehicle types will be discussed in greater detail in a subsequent section of the report.

With the route alignments thus defined, certain basic parameters for the varying service options were developed, as follows:

- IVC/SDSU Callexico Shuttle Route – Given the route alignment described previously, this route would use 1 bus to provide a 60 minute frequency of service or 2 buses to provide a 30 minute frequency of service.

The span of service would operate from approximately 6:00AM to 10:30PM when school is in session.

The range of annual operating costs for this route is described in Table 7.

- IVC/SDSU-Brawley Shuttle Route – Given the route alignment described previously, this route would also use 1 bus to provide a 60 minute frequency of service or 2 buses to provide a 30 minute frequency of service.

The span of service would operate from approximately 12:00PM to 10:30PM when school is in session.

The range of annual operating costs for this route is also described in Table 7.

- SDSU Express Route – Given the route alignment described previously, this route would use 1 bus to provide a 90 minute frequency of service or 3 buses to provide a 30 minute frequency of service.

The span of service would operate from approximately 12:00PM to 10:30PM when school is in session.

The range of annual operating costs for this route is also described in Table 7.

- IVC/SDSU Main Campus Route – Given the route alignment described previously, this route would use 1 bus to provide a 4.5 hour (i.e., 270 minute) frequency of service or 3 buses to provide a 90 minute frequency of service.

The span of service would operate from approximately 6:00AM to 6:00PM when school is in session.

The range of annual operating costs for this route is also described in Table 7.

- SDSU-Calexico/SDSU Main Campus Route – Given the route alignment described previously, this route would use 1 bus to provide a 4 hour 45 minute (i.e., 285 minute) frequency of service or 3 buses to provide a 95 minute frequency of service.

The span of service would operate from approximately 6:00AM to 6:00PM when school is in session.

The range of annual operating costs for this route is also described in Table 7.

- IVC/NAU Yuma Campus Route – Given the route alignment described previously, this route would use 1 bus to provide a 3 hour (i.e., 180 minute) frequency of service or 2 buses to provide a 90 minute frequency of service.

The span of service would operate from approximately 6:00AM to 6:00PM when school is in session.

The range of annual operating costs for this route is also described in Table 7.

Table 7 – Shuttle Service Alternatives – Operating Parameters

Route	Proposed Frequency (Minutes)	Buses	Estimated Annual Operating Cost (in 2016 Dollars)		
			Passenger Van	Body-on-Chassis "Cutaway"	Standard Transit Bus
IVC/SDSU Calexico Shuttle Route	60	1	\$257,500	\$286,000	\$389,900
IVC/SDSU Calexico Shuttle Route	30	2	\$514,900	\$572,100	\$779,800
IVC/SDSU-Brawley Shuttle Route	60	1	\$163,800	\$182,000	\$248,100
IVC/SDSU-Brawley Shuttle Route	30	2	\$327,700	\$364,100	\$496,300
SDSU Express Route	90	1	\$163,800	\$182,000	\$248,100
SDSU Express Route	30	3	\$491,500	\$546,100	\$744,400
IVC/SDSU Main Campus Route	270	1	\$187,200	\$208,000	\$283,600
IVC/SDSU Main Campus Route	90	3	\$561,700	\$624,100	\$850,700
SDSU-Calexico/SDSU Main Campus Route	285	1	\$187,200	\$208,000	\$283,600
SDSU-Calexico/SDSU Main Campus Route	95	3	\$561,700	\$624,100	\$850,700
IVC/NAU Yuma Campus Route	180	1	\$187,200	\$208,000	\$283,600
IVC/NAU Yuma Campus Route	90	2	\$374,500	\$416,100	\$567,200

## 17.0 IDENTIFICATION OF DECISION CRITERIA

In order to evaluate the effectiveness of the potential alternative services that were developed, some basic guidelines upon which they can be compared were identified and defined.

Transit operators generally have a set of guidelines and performance criteria by which to define and evaluate their services. For this study – given the specialized nature of the proposed service – it is also important to recognize and understand that the development of the service design was informed by the public input and stakeholder outreach process throughout the study, and that service level particulars and route alignment designs were shaped by the transit needs of the academic community. Nonetheless, the service desires of the public were balanced with the ability to plan for and provide effective transit service.

These inputs and the potential decision criteria, along with the various service alternatives previously discussed, were the subject of a planning workshop held internally among study team members and several key stakeholders. For the potential academic community shuttle services in the Imperial Valley, it was determined that the decision criteria would essentially use certain *Design/Service Guidelines*, which were considered in conjunction with an important *Performance Guideline*, as follows:

- Design/Service Guidelines – The design/service guidelines relate to how the potential shuttle service options satisfy the following criteria:
  - Directness and Travel Time – All of the potential service options directly serve the three campuses.

The main differentiating item to be considered in terms of directness really has to do with any potential connections that may be required and how that may impact total travel time. Should the IVC/SDSU-Brawley and IVC/SDSU-Calexico shuttle routes be the only services operated, for example, then someone needing to travel between the two SDSU campuses would require a transfer.
  - Roadway Geometry – None of the potential service options are proposed to operate through any potentially difficult intersections or roadway segments.
  - Comfort – All of the potential shuttle service options are designed to appeal to the customer (i.e., students, faculty and staff, as well as the general public), which means that it is assumed that the vehicles, bus stops and other physical elements that will make the system appealing to the customer are utilized in all potential options.

- Reliability – All of the potential shuttle service options have been developed with assumed running and cycle times that – given current traffic conditions – should allow for a reliable operation given the various frequencies of service presented in this document.
- Frequency and Span of Service – All of the potential shuttle service options have been developed with varying frequencies of service. The spans of service (i.e., the hours during the day during which service is available) for each option were most directly informed by the public input received during the outreach process. Frequency goes hand-in-hand with all of the above criteria in the design; however, it is also important to recognize that frequency of service also has the most direct impact on operating costs, with more frequent service being more costly to provide.
- Load Factor – Load factor is the ratio of the estimated peak ridership load to the number of available seats. Throughout the public input and stakeholder outreach process, the potential size and scale of the market between campuses was discussed and evaluated in terms of potential vehicles that would be most appropriate for this type of service, with the understanding that the vehicles utilized would be of a sufficient size so that most (i.e., upwards of approximately two-thirds) riders had a seat.

The vehicle type selection will be discussed in greater detail in a subsequent section of the report; however, it should be recognized that the selection of the vehicle type, the size of the potential ridership (which will also be discussed in a subsequent section of the report), and other factors such as commonality and interoperability with the existing fleet all have a major impact on the potential operating and capital costs of the service.

- Fare Policy – It was determined that the fare policy for all of the potential shuttle service options would be the same, with an important factor being that any proposed shuttle service would not have a fare policy that would “undermine” the existing IV Transit service in the Imperial Valley.
- Performance Guideline – The primary performance differentiator among the potential shuttle service options is the potential *operating cost* and the ability to secure and provide funding for any new shuttle service in the Imperial Valley.

At the internal workshop, it was determined that the operating cost among the various options – more than any other significant factor – was the performance factor that could most readily differentiate among these alternatives.

The use of these guidelines – as well as various other considerations – in the analysis and screening of the alternatives is described in the next section of the report.



## 18.0 ANALYSIS OF ALTERNATIVES/SCREENING PROCESS

As was previously mentioned, all of the various inputs and the potential decision criteria – along with the various service alternatives previously discussed – were the subject of a planning workshop held internally among study team members and several key stakeholders.

In the previous section of the report, the various criteria that were not differentiators among the potential shuttle service options were identified. However, for the key differentiators (identified in *italics* in the following section) among the potential shuttle service options, an analysis and screening process was undertaken.

The outcome of the screening process and the workshop – which informs and leads into the development of the recommended plan that will be discussed in a subsequent section of the report, along with the development of additional estimated performance metrics such as ridership and revenue – were as follows:

- Single Route – As was previously mentioned, this concept – although relatively straightforward – was not advanced further beyond this initial conceptual stage, as its nature would not allow for the “tailoring” of service levels between the various campuses.

Due to this significant drawback that negatively impacts *operating cost*, the single route option was not utilized any further throughout the planning process.

- IVC/SDSU Callexico Shuttle Route and IVC/SDSU-Brawley Shuttle Route – These alternatives, when taken together, allow for the tailoring of service levels between IVC and either SDSU campus, thus positively impacting *operating cost*.

However, these options also “force” transfers at the IVC campus for those traveling between the SDSU campuses (should no other services be provided), thus negatively impacting *directness* and *travel time*.

Given the significantly higher estimated *operating costs* when operating every 30 minutes, only the hourly service versions of these options were advanced for further consideration.

- SDSU Express Route – This alternative allows for a “one seat non-stop” ride between the two SDSU campuses.

Because of its positive impact on *travel time* and *directness*, this option was advanced for further consideration.

- IVC/SDSU Main Campus Route, SDSU-Callexico/SDSU Main Campus Route and IVC/NAU Yuma Campus Route – Given the additional *operating costs* that these

services would incur, and the fact that they are “extra-jurisdictional” and essentially provide significant levels of service outside of Imperial County, it was determined that these routes would only be presented as potential longer-term options.

In addition, the extra-jurisdictional nature of these route options place them outside of the typical funding stream for services that are funded by the Imperial County Transportation Commission, thus supporting making them longer-term options.

Summary – In this section of the report, the process by which the various alternatives were developed was described, and the screening process by which only certain versions of the potential shuttle service options were advanced was also presented.

In the next section of the report, the manner in which these potential shuttle service options are developed into a recommended plan is presented. This section will also contain an implementation and phasing plan, additional performance metrics for the recommended plan (such as ridership and revenue estimates), and an analysis and description of the selection of a vehicle type.

## 19.0 INTRODUCTION TO IMPLEMENTATION OF RECOMMENDED PLAN

Three of the college campuses in the Imperial Valley – Imperial Valley College (IVC), near the City of Imperial, and San Diego State University-Imperial Valley (SDSU-IV), with campuses in both Calexico and Brawley – are part of a study team jointly led by the Imperial County Transportation Commission (ICTC) and the Southern California Association of Governments (SCAG) which was awarded a planning grant in early 2015 to pursue the development of a potential shuttle service linking the three facilities.

The IVC campus near the City of Imperial is currently served by several Imperial Valley Transit (IV Transit) routes. The SDSU-IV Calexico campus is not directly served by transit, although several IV Transit routes operate within walking distance. The SDSU-IV Brawley campus is currently unserved by transit.

The purpose of the Campus Transit Study is to recommend transit service and access improvements between the three campuses. These improvements may include creating a new dedicated transit service that serves the colleges as well as leveraging existing bus service.

This study is a collaborative effort between IVC and SDSU-IV – and their collaborative Imperial Valley University Partnership (IVUP) program – and ICTC and SCAG.

This memorandum describes the phased implementation plan for a recommended set of services that serve all of these campuses. Several estimated service metrics are also presented, including estimated ridership and revenues. Sources of funding are also discussed, as are the potential greenhouse gas emissions impacts from several different sources.

## 20.0 PHASED IMPLEMENTATION OF RECOMMENDED PLAN

As presented in a prior section of this report, several route and service alternatives were developed that would connect the three campuses – Imperial Valley College (IVC) and the San Diego State University (SDSU) – Imperial Valley satellite campuses in Calexico (SDSU-Calexico) and Brawley (SDSU-Brawley).

After the screening process described previously, some of the route and service alternatives were eliminated from further consideration. The remaining route and service alternatives were then developed into a recommended plan, which is presented here. This recommended plan of services is also presented with its implementation phases, so as to allow for this new service in the Imperial Valley to be implemented gradually, as funding becomes available.

The phased implementation process for the recommended plan is as follows:

### Phase 1 – Implement IVC Transfer Concept

This initial phase is expected to be implemented between 2017 and 2025. With this phase, the IVC/SDSU-Calexico and IVC/SDSU-Brawley Shuttle Routes will be implemented, thus connecting the IVC campus with both of the SDSU campuses.

However, as has been previously noted, a person wishing to travel between the SDSU campuses will need to transfer at IVC, which will function as a “hub” for the shuttle system. Phase 1 is illustrated in Figure 32.

The service plan for Phase 1 is as follows:

- SDSU-Brawley/IVC Route is estimated to require approximately 60 minutes cycle time, and would utilize 1 bus to provide a 60 minute frequency of service
  - Service would operate from approximately 12:00PM to 10:30PM when school is in session
  - Would serve the IVC campus, the South Plaza transit center in Brawley and the SDSU-Brawley campus
- SDSU-Calexico/IVC Route is also estimated to require approximately 60 minutes cycle time, and would also utilize 1 bus to provide a 60 minute frequency of service
  - Service would operate from approximately 6:00AM to 10:30PM when school is in session
  - Would serve the IVC campus and the SDSU-Calexico campus

Figure 32 – Phase 1 Service – IVC Transfer Concept



Source Mapping: Google

#### Phase 2 – Implement SDSU Express Shuttle Route In Addition to IVC Transfer Concept

The second (and final) phase is expected to be implemented between 2020 and 2028. With this phase, the IVC/SDSU-Calexico and IVC/SDSU-Brawley Shuttle Routes will be complemented by the implementation of the SDSU Express Shuttle Route, which operates “express” between the two SDSU campuses.

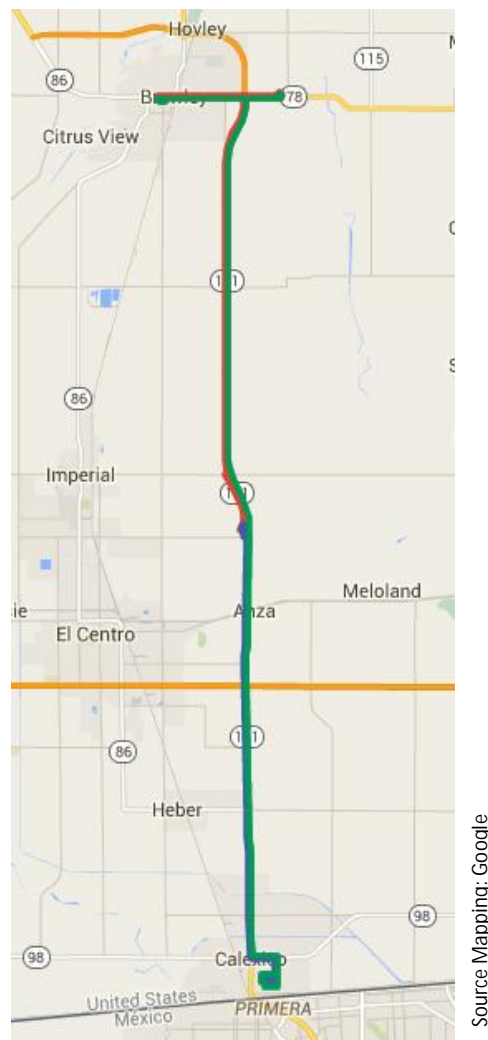
This service pattern allows any passenger traveling between any campus to have a “one seat ride” that does not require a transfer. Phase 2 is illustrated in Figure 33.

The service plan for Phase 2 is as follows:

- SDSU-Brawley/IVC Route is estimated to require approximately 60 minutes cycle time, and would utilize 1 bus to provide a 60 minute frequency of service

- Service would operate from approximately 12:00PM to 10:30PM when school is in session
  - Would serve the IVC campus, the South Plaza transit center in Brawley and the SDSU-Brawley campus
- SDSU-Calexico/IVC Route is also estimated to require approximately 60 minutes cycle time, and would also utilize 1 bus to provide a 60 minute frequency of service
  - Service would operate from approximately 6:00AM to 10:30PM when school is in session
  - Would serve the IVC campus and the SDSU-Calexico campus
- SDSU-Calexico/SDSU-Brawley Express Route is estimated to require approximately 90 minutes cycle time, and would utilize 1 bus to provide a 90 minute frequency of service
  - Service would operate from approximately 12:00PM to 10:30PM when school is in session
  - Would serve the SDSU-Calexico campus, the South Plaza transit center in Brawley and the SDSU-Brawley campus

Figure 33 – Phase 2 Service – Implement SDSU Express Shuttle Route



### Longer Term Phases

As was discussed in a prior section of the report, there are several service options which do not fit the current funding structure for providing public transportation services in the Imperial Valley, and thus would be implemented in the “longer term” (i.e., at some point after the completion of Phase 2). These phases serve locations outside of Imperial County, and as such extra-jurisdictional services fall outside the normal funding mechanisms utilized by the Imperial County Transportation Commission.

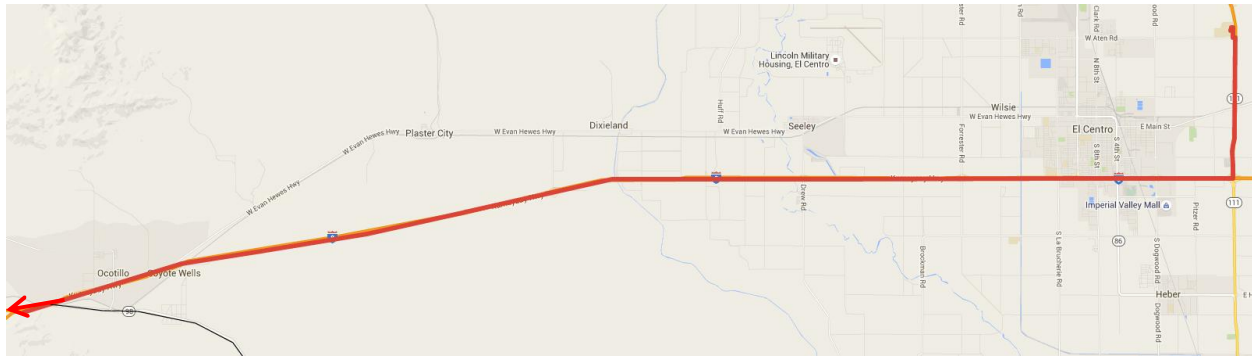
No detailed metrics beyond those utilized to estimate operating costs (and presented in a prior section of the report) were developed for these services. Nonetheless, the potential exists to operate these services in the longer term, depending on the ability to obtain additional funding from sources that may, for example, include the academic institutions.

The potential longer term phases are as follows:



- Phase 3 – Implement SDSU Main Campus Service – In this longer-term phase, shown in Figure 34, service would be provided between the IVC campus and the SDSU Main Campus in San Diego primarily via Interstate 8.

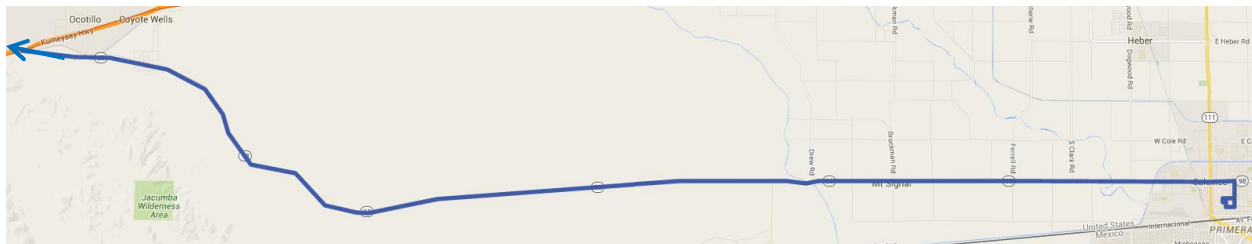
Figure 34 – SDSU Main Campus Service from IVC



Source Mapping: Google

- Alternative Phase 3 – Implement SDSU Main Campus Service from SDSU-Calexico – As the option presented previously requires SDSU-Calexico students to first travel to or from IVC in order to travel to or from the SDSU Main Campus, an alternative option would instead provide the SDSU Main Campus service from SDSU-Calexico, as shown in Figure 35. This service would operate via State Route 98 (in Imperial County) and Interstate 8.

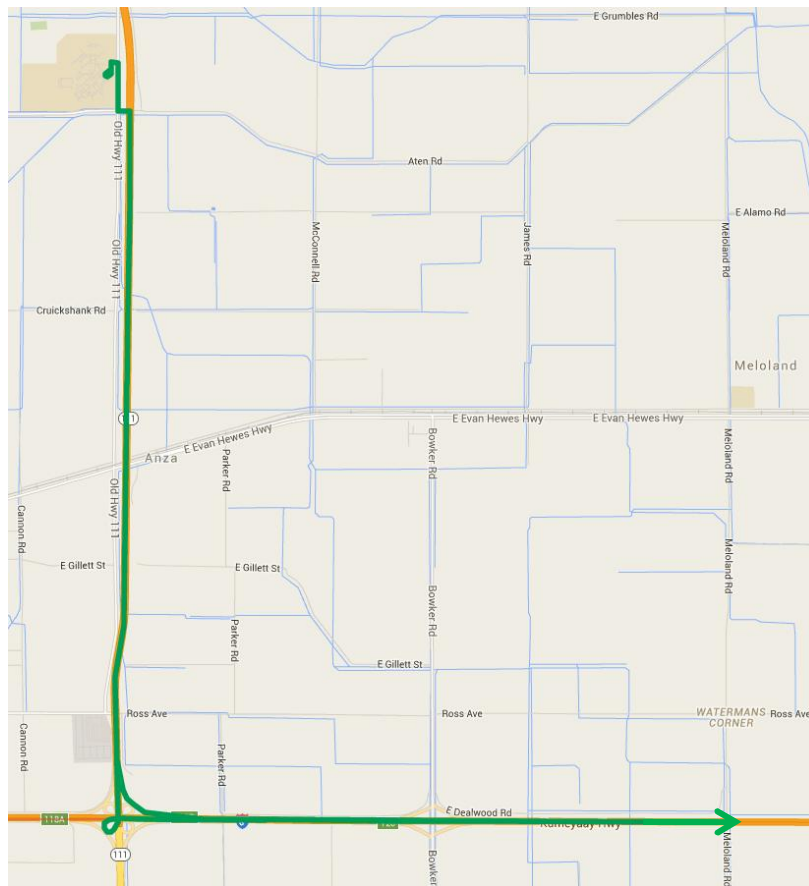
Figure 35 – SDSU Main Campus Service from SDSU-Calexico



Source Mapping: Google

- Phase 4 – Implement Northern Arizona University (NAU) Yuma Campus Service – In this ultimate longer term option, service would be provided between the IVC campus and the NAU Yuma Campus (primarily via Interstate 8), as shown in Figure 36.

Figure 36 – NAU Yuma Campus Service



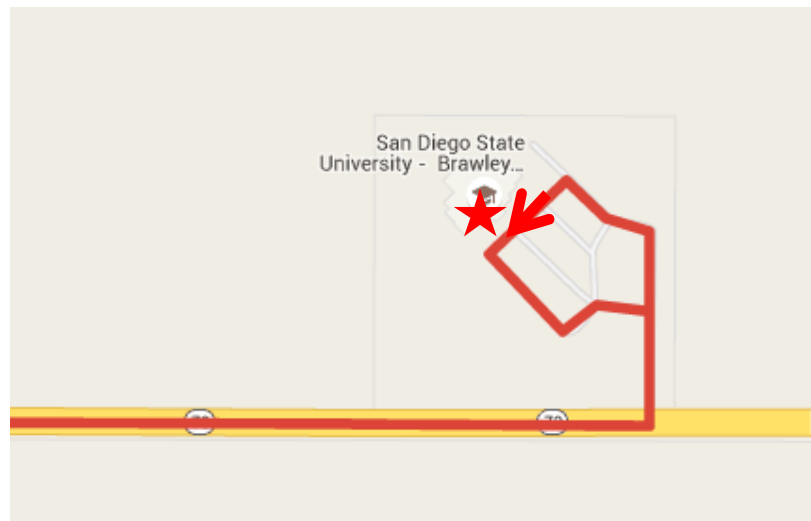
Source Mapping: Google

### Bus Stop Locations

In addition to utilizing the existing bus stops at the IVC campus and at the South Plaza transit center in Brawley, the proposed shuttle service alternatives would also use new bus stops at the SDSU-Brawley and SDSU-Calexico campuses.

At the SDSU-Brawley campus, the new bus stop would be located along the front of the classroom building (i.e., the sole campus building), as indicated by the star shown in Figure 37.

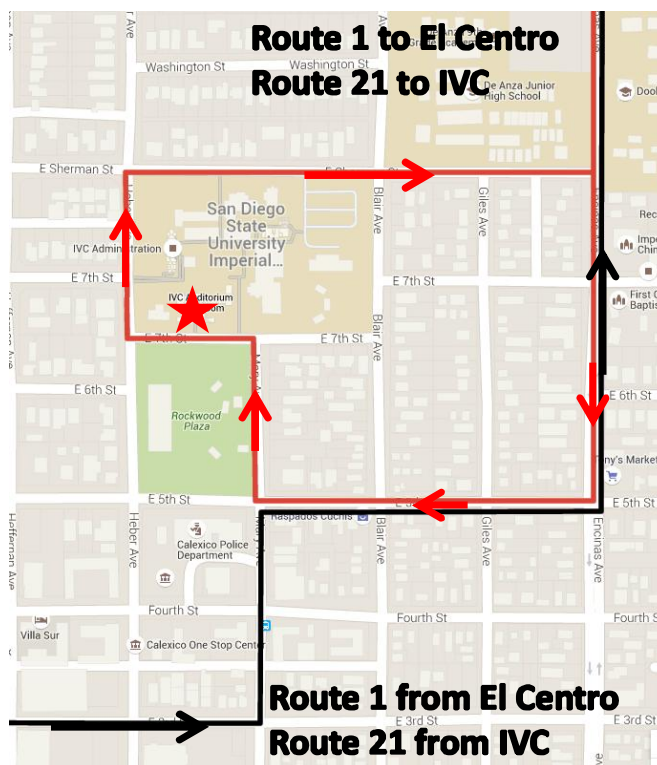
Figure 37 – New SDSU-Brawley Bus Stop Location



Source Mapping: Google

As was previously mentioned in the Existing Condition section of the report, the SDSU-Calexico campus is not directly served by the IV Transit system; however, several IV Transit routes are within walking distance. At the SDSU-Calexico campus, the new bus stop would be located along East 7<sup>th</sup> Street at the “main entrance” to the campus, as indicated by the star shown in Figure 38. Also shown are the existing IV Transit routes in the area.

Figure 38 – New SDSU-Calexico Bus Stop Location



Source Mapping: Google

It is assumed that each of the new bus stops would be equipped with a passenger waiting shelter as well as benches. The appropriate signage and trash containers will also be provided. It assumed – for the planning purposes of this study – that SDSU will maintain the two new bus stops, as they will be directly serving its facilities.

### Vehicle Number and Type

The service plan described above would require two vehicles in Phase 1 and three vehicles in Phase 2. With the need for a spare vehicle, this means that a total of three vehicles in Phase 1 and four vehicles in Phase 2 would be required to provide the recommended level of service.

As was mentioned in a previous section of the report, throughout the public input and stakeholder outreach process, the potential size and scale of the market between campuses was discussed and evaluated in terms of potential vehicles that would be most appropriate for this type of service, with the understanding that the vehicles utilized would be of a sufficient size so that most (i.e., upwards of approximately two-thirds) riders had a seat. On certain route types, IV Transit allows 25% of riders to stand for a limited time; however, the new campus shuttle services may likely be viewed as their own new route category.

The three vehicle types considered were a standard transit bus (shown in Figure 39), which are typically available in lengths of 30, 35, 42 or 60 feet, a body-on-chassis “cutaway” vehicle (shown in Figure 40), or a typical 15 passenger van (shown in Figure 41).

Figure 39 – Standard Transit Bus



Figure 40 – Body-on-Chassis "Cutaway" Vehicle



Figure 41 – Passenger Van



As part of the stakeholder outreach process, an internal workshop was held among study team members where various factors were considered in the vehicle type selection, including the size of the potential ridership (which will be discussed in a subsequent section of the report), and other factors such as commonality and interoperability with the existing IV Transit fleet.

It was determined that a standard transit bus – most likely in a 35 foot length – be recommended to provide the academic shuttle service in the Imperial Valley. Although various factors were considered, the following were especially pertinent:

- Retains a level of commonality and interoperability with the existing fleet (and therefore to likely reduce life cycle maintenance costs);
- Standard transit bus frames typically have the most options available in terms of alternative powerplants and fuel sources, which will allow for the most flexibility in selecting an alternative fuel bus for the service (and which will be discussed in a subsequent section of the report); and
- The size of a standard transit bus would mean that should higher loads occur at particular times of day or on a certain repeating basis, a more comfortable ride along State Route 111 would be provided as more passengers would be likely to obtain a seat.

The vehicle selection will clearly have a significant impact on the potential capital costs of the service, as will be described subsequently.

### Other Transit Considerations

There are several additional transit planning considerations that should be explicitly described as part of this recommended plan. These are as follows:

- Ridership Eligibility – Throughout this report, it has been assumed that the Imperial County Transportation Commission would administer this academic shuttle service, and – most likely – integrate it into the existing IV Transit service (whether via the existing contract operator or by another contractor). If this service is to be part of the IV Transit system, then it must be available to the general public and not solely to members of the academic community, as required by federal funding regulations.
- Stopping Pattern – It is assumed that the routes described in this recommended plan will only stop at the bus stops described in the route descriptions previously stated. Therefore, the shuttle services will provide an express “closed door” bus service between stops, and not make any additional stops.
- Fare/Transfer Policy – It is assumed that integration with the existing IV Transit fare structure will be undertaken in order to maximize convenience and increase potential ridership. In addition, this allows for no “fare advantage” to using any of the new shuttle routes as opposed to the existing IV Transit services.
- Branding – All three of the new shuttle services described in this recommended plan will be branded as the *“Imperial Valley University Transit Shuttle”*. Although it is recognized that branding such a small “sub-fleet” may create some dispatching issues for an operator, the study team determined that the benefits to a strong branding identity would allow not only the students but also the academic institutions themselves to have a stronger “sense of ownership” with regard to the service.



- Operating/Maintenance/Storage Facility Considerations – Adding four new buses to the existing IV Transit fleet shouldn't pose any issues with regards to the existing operating and maintenance base or its operator.  
However, it should be noted that should an alternative fuel source be selected to provide this service (i.e., especially should it be one that differs from the current fuel source), then additional capital infrastructure needs may be necessary, depending upon the fuel source selected. For example, although there is at least one commercial compressed natural gas (CNG) fueling station in El Centro, it is likely that the transit operator will wish to have its own CNG fueling facility at its operations and maintenance base.
- Personnel – As will be seen in a subsequent section, by Phase 2 of the recommended plan there will be three additional peak vehicles required to provide the service. In terms of personnel needs, the number of new bus operators needed may vary depending on how the operator schedules drivers and any potential contractual agreements regarding such driver scheduling. Nonetheless, should the service be operated, it can be expected that there would be a need for new bus operators (i.e., likely approximately 3 to 6 new drivers). Should the existing operator operate the service, existing supervisory and maintenance personnel would likely be able to be utilized.

#### Potential Modifications to Existing IV Transit System

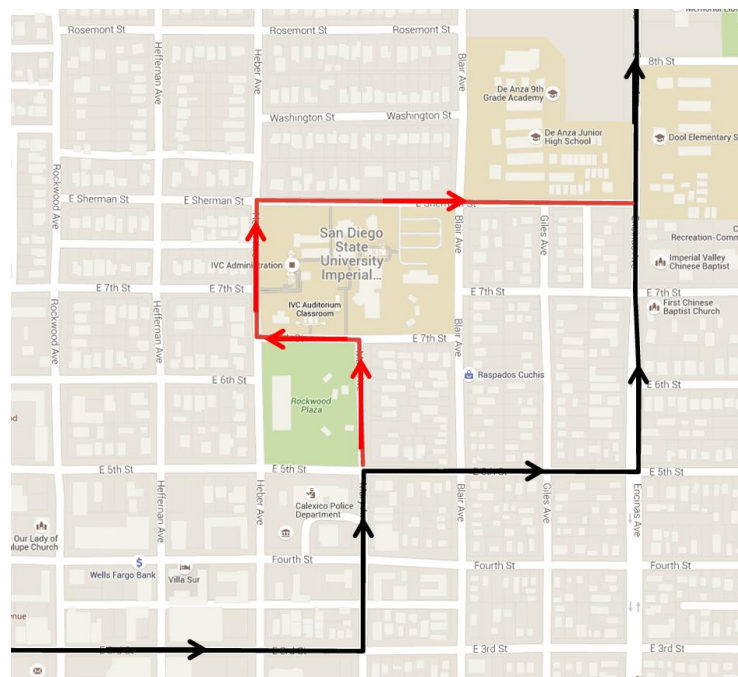
The upcoming Short Range Transit Plan (SRTP) to be undertaken by the Imperial County Transportation Commission (ICTC) will consider this recommended plan and determine its prioritization within the array of needs for the entire IV Transit system.

Nonetheless, as part of the SRTP, this recommended plan will be examined in conjunction with potential modifications to the existing IV Transit system that may also support better connecting the various academic campuses with each other. These may include:

- Operate Route 21 *IVC Express* using a modified route alignment in Calexico that directly serves the SDSU-Calexico campus, as shown in Figure 42, with the alternative route alignment for Route 21 *IVC Express* shown in red.



Figure 42 – Potential Modified Route 21 *IVC Express* Alignment in Calexico



Source Mapping: Google

- Operate Route 22 *IVC Express* via SDSU Brawley campus

These potential modifications may not be “cost neutral” and will be examined as part of the upcoming SRTP.

## 21.0 ESTIMATED IMPACTS OF RECOMMENDED PLAN

The recommended plan described in this section of the report was further analyzed in order to develop additional metrics by which to gauge the potential efficacy of the service plan. These included approximate estimates – for planning purposes – of total operating costs, capital costs, ridership, revenue and farebox recovery.

### Annual Operating Cost Estimates

The total operating cost estimates – by phase – are presented below. As part of the development of the recommended plan, several assumptions were required to be utilized. These are as follows:

- For planning purposes, it was assumed that any shuttle services oriented to the academic community would operate for 201 days per year. This was based on the current IVC Express service provided by IV Transit and the number of school days.
- The estimated costs of these service alternatives were all calculated consistently amongst the alternatives utilizing the projected revenue hours of service.
- In order to develop the estimated potential annual operating costs, and given the projected revenue hours of service for each option, the revenue hours were multiplied by \$117.57 per hour (in current dollars) for the potential standard transit bus operating cost, as this is the type of vehicle to be utilized. This estimated operating cost per hour includes all costs associated with operating and providing the service, including bus operators (i.e., drivers).

With these assumptions thus defined, the total annual operating cost estimates are as follows:

- Phase 1
  - SDSU Brawley-IVC Route = \$248,100/year
  - SDSU Callexico-IVC Route = \$389,900/year
  - TOTAL Phase 1 Cost = \$638,000/year
- Phase 2
  - SDSU Brawley-SDSU Callexico Express = \$248,100/year
  - TOTAL Phases 1 & 2 Cost = \$886,200/year

### Capital Cost Estimates

The critical capital costs estimates for the proposed shuttle services are those associated with new transit vehicles and the new bus shelters. These are as follows:

- New Bus Stops = approximately \$40,000
  - This assumes a capital cost of approximately \$20,000/bus stop, with one at SDSU-Brawley and one at SDSU-Callexico.

- New standard transit buses = approximately \$3,000,000 in vehicle costs
  - This assumes a unit cost of approximately \$750,000 per bus for an alternative fuel (or electric) bus. Costs may vary; however, an examination of approximate vehicle costs appears to indicate that this assumption is appropriate for planning purposes.
  - This also assumes three vehicles are needed for revenue service by Phase 2, with an additional spare bus (i.e., utilizing a 20% spare ratio).

### Annual Ridership and Revenue Estimates and Farebox Recovery Estimates

The recommended service plan for the proposed academic shuttle services allow for the development of estimated annual ridership, revenue and farebox recovery figures for each phase.

For estimating annual ridership, a lowered level of productivity (i.e., boardings per hour) for similar routes (i.e., similar IV Transit routes) was utilized, with the productivity levels varying by phase.

For estimating annual revenue, it was assumed that each boarding passenger represented \$1.25 in revenue, which is the current student fare on IVC Express services operated by IV Transit.

Finally, the annual farebox recovery for each phase was determined utilizing both the estimated annual revenue as well as the previously estimated annual operating costs.

The estimated annual ridership, revenue and farebox recovery, by phase, are as follows:

- Phase 1 Estimates
  - Phase 1 Annual Ridership
    - SDSU Brawley-IVC Route = 19,000/year
    - SDSU Calexico-IVC Route = 59,700/year (*approximately 30,000/year from existing IV Transit Route 21*)
    - TOTAL Phase 1 Ridership = 78,700/year
  - Phase 1 Annual Revenue
    - SDSU Brawley-IVC Route = \$23,700/year
    - SDSU Calexico-IVC Route = \$74,600/year
    - TOTAL Phase 1 Revenue = \$98,300/year
  - Phase 1 Farebox Recovery = 15%

- Phase 2 Estimates
  - Phase 2 Annual Ridership
    - SDSU Brawley-IVC Route = 14,200/year
    - SDSU Calexico-IVC Route = 44,800/year (*approximately 30,000/year from existing IV Transit Route 21*)
    - SDSU Calexico-SDSU Brawley Express Route = 27,400/year
    - TOTAL Phase 2 Ridership = 86,400/year
  - Phase 2 Annual Revenue
    - SDSU Brawley-IVC Route = \$17,800/year
    - SDSU Calexico-IVC Route = \$56,000/year
    - SDSU Calexico-SDSU Brawley Express Route = \$34,300/year
    - TOTAL Phase 2 Revenue = \$108,100/year
  - Phase 2 Farebox Recovery = 12%

The estimated farebox recovery rates of 15% (in Phase 1) to 12% in Phase 2 indicate that the recommended service plan should be considered as part of the overall transit needs in the upcoming Short Range Transit Plan, as was previously mentioned.

Some relatively minor additional sources of revenue – such as paid advertising on board the vehicles – would add some additional revenue; however this amount would likely provide a *de minimis* amount of additional funding and should not be viewed as significantly impacting the potential estimated farebox recovery rates.

## 22.0 REVIEW OF FUNDING SOURCES

As was previously stated, all phasing assumptions are contingent on funding availability, and this recommended plan for the academic shuttle service will also be considered during the next Short Range Transit Plan (S RTP) study process that will be undertaken by the Imperial County Transportation Commission (ICTC).

Nonetheless, it should be kept in mind that current sources of state and federal funds are essentially prioritized and “spoken for”, with the implementation of additional circulator routes considered a priority by ICTC. This implies that the diversion of existing funds for new intercampus shuttle services would mean service reductions elsewhere in the IV Transit system.

This is the primary reason why funding new service under current programs could require several years’ lead time, and thus why Phases 1 and 2 are anticipated – given current funding programs – to not be fully implemented potentially until about 2025 or 2028.

However, it is important to review the various funding programs that may be available for the proposed academic shuttle service; these are as follows:

- Federal Funding Sources
  - Section 5307 Urbanized Formula Funding – Section 5307 is the urbanized grant program to support urban transit services. Officially this funding source is not used for operating costs, but this funding source can be used to offset maintenance and thereby operating cost for services. The use of this funding source for operating and maintaining regular service must be offset by a 50% local match. This funding source is already used by IV Transit.
  - Section 5339(c) Low or No Emission Vehicle Program – This competitive grant program is for the purchase of infrastructure to support the deployment of low or no emission transit vehicles. This includes the purchase of vehicles as well as the fueling resources for the vehicles. As a subset of Section 5339 funds, this funding source requires a 20% local match.
  - Congestion Mitigation and Air Quality (CMAQ) Program – CMAQ provides funding to areas in nonattainment or maintenance for ozone, carbon monoxide, and/or particulate matter. States that have no nonattainment or maintenance areas still receive a minimum apportionment of CMAQ funding for either air quality projects or other elements of flexible spending. Funds may be used for any transit capital expenditures – such as buses – otherwise eligible for FTA funding as long as they have an air quality benefit. This funding source requires a 20% local match.

- State Funding Sources
  - LTF – The Transit Development Act (TDA) established the Local Transportation Fund (LTF) as a major funding source for transit. LTF is based on a quarter cent sales tax that is allocated to counties based on the tax collections. The requirements for LTF are for a 20% farebox recovery in urbanized areas or 10% farebox recovery in non-urbanized areas. IV Transit already uses all the LTF allocated to the service area.
  - STA – The other funding source that comes from the TDA is the State Transit Assistance (STA). This funding source comes from a tax on diesel fuel. This source can be used for operations or for capital. Half of STA funds are allocated based on county population while the other half are allocated based on operator revenues from the prior year. The requirements for LTF are for a 20% farebox recovery in urbanized areas or 10% farebox recovery in non-urbanized areas. Currently IV Transit uses this funding source for capital.
  - Low Carbon Transit Operation Program – This program is administered by CalTrans in cooperation with the California Air Resource Board (CARB) to provide capital and operating assistance for programs that reduce greenhouse gas emissions. For agencies that serve disadvantaged communities, 50% of LCTOP monies can be used on projects that serve disadvantaged passengers. This program is funded from 5% of the proceeds from cap-and-trade auctions. Currently this fund is being used for the Calexico Intermodal Transportation Center.
- Local Area Funding Sources
  - Fares – Fares refer to the direct payments from riders. TDA has specific requirements regarding minimum amount of operating funding that must come from fares: 20% farebox recovery in urbanized areas or 10% farebox recovery in non-urbanized areas. Fares can be used as a local match for Federal funding sources.
  - U-Pass – Many transit systems that serve a college or university have established a U-Pass program. A U-Pass program allows students at the college or university to access the bus system with either a special pass or student identification card. The U-Pass would be funded either from a student fee that is charged to all students or from parking fees. While – in theory – this funding source can be

used to fund the recommended shuttle services, it could also have the added benefit of encouraging overall use of IV Transit services as students would not have to buy a bus pass to access service if they are participating in the U-Pass program.

Nonetheless, the economic particulars of a U-Pass service would need to be more carefully examined as part of a separate study.

- Local Option Sales Tax Measure – An option that is available to ICTC is to propose a local option sales tax measure. This will require a local ballot referendum for a tax that would provide funding either for overall transit service, or a smaller measure that would be dedicated to transit access to the colleges. It should be noted that as sales taxes already exist in Imperial County, this would likely impact the electorate's appetite for an additional tax.



## 23.0 GREENHOUSE GAS EMISSIONS ANALYSIS

This section of the report summarizes the results of the greenhouse gas (GHG) emissions analysis for the proposed transit shuttle routes between Imperial Valley College (IVC) and the San Diego State University (SDSU) satellite campuses in Brawley and Calexico campuses. The recommended plan includes three potential transit routes that will be implemented in two phases from 2017 to 2028. The Imperial County Transportation Commission (ICTC), the Southern California Association of Governments (SCAG), IVC and SDSU are considering different engine and fuel types (e.g., diesel, electric, etc.) for the buses that will operate on the transit routes.

The study team estimated GHG emissions for each of the fuel type alternatives based on vehicle miles traveled (VMT) and ridership increases for the shuttle trips, and the corresponding VMT reductions in passenger vehicles. The alternative fuel types analyzed in this report include buses powered by compressed natural gas (CNG), hydrogen/fuel cell buses and “straight” electric buses (i.e., buses powered by batteries which have no vehicle-based emissions). In the Imperial Valley, all of these types of alternative fuels would provide lower GHG emissions when compared with diesel fuel-powered buses.

As discussed in this memorandum, the GHG emission benefits of the transit service depend on the fuel types. Both diesel and compressed natural gas (CNG) bus engines result in an annual net increase in GHG emissions in Phase 1. Electric and hydrogen buses result in a net annual decrease in GHG emissions when considering the replacement of VMT from passenger vehicles. The SDSU-Calexico/SDSU-Brawley Express Route would result in a net reduction in GHG emissions for all fuel types in Phase 2.

### Recommended Plan Description

Assuming Phase 1 would begin in 2017 and end in 2025, with implementation of transit routes between SDSU-Brawley and IVC and SDSU-Calexico and IVC. Phase 2 of the project, which includes the addition of an “express” route between SDSU-Calexico and SDSU-Brawley, is anticipated to begin in 2020 and end in 2028. Annual VMT for the operation of the bus service were based on the length of the route, proposed frequency of daily trips based on hours of operation, and the proposed days of operation per year. Annual Auto VMT was calculated based on the length of auto trip reduced consistent with the length of the shuttle route, the total daily ridership, and proposed days of operation.

### Methodology

The emissions analysis was based on the GHG Quantification Methodology for the California State Transportation Agency Transit and Intercity Rail Capital Program (“methodology”)

developed by the California Air Resources Board (ARB 2016). The methodology was developed to be used by grant applicants, and although the project is not being considered for grant funding at this time, the methodology for GHG emission reductions is considered appropriate for this analysis. The methodology applies at the project-level, provides uniform methodologies that can be applied statewide, uses existing and proven methods, and uses project-level data when available.

This analysis used calculations from the methodology to quantify the GHG emissions associated with new/expanded transportation service. GHG emissions were estimated using spreadsheet calculations and emission factors that account for the production and distribution of the different fuel types. These “well-to-wheels” emission factors were obtained from Emission Factors for 2014 (i.e., EMFAC2014) and account for the emissions produced from the production and distribution of the different fuel types, including hydrogen and electricity, as well as any associated exhaust emissions.

Based on the operational schedules discussed above, emissions factors for passenger vehicles and buses were based on 2017 model years for Phase 1 and 2020 model years for Phase 2. Given that exhaust emissions rates of mobile vehicles are expected to decrease over time as stricter standards take effect, to generate conservative emission estimates the emissions were estimated using the earliest possible calendar year operation for each phase. The emission reductions were calculated as a net change in emissions in metric tons of carbon dioxide equivalents per year (MT CO<sub>2</sub>e per year). The net change in emissions in MT CO<sub>2</sub>e per year was calculated for each route in each phase.

## Results

The results of the emission calculations are presented in Tables 8 through 11. Table 8 presents the annual GHG emissions for the different transit fuel types for Phase 1 of the project. As shown in Table 1, diesel and CNG buses would result in the largest net increase in GHG emissions at 363 and 312 MT CO<sub>2</sub>e per year, respectively. Electric buses would result in the lowest level of GHG emissions at 88 MT CO<sub>2</sub>e per year.

Table 8 – Phase 1 Bus Emissions (MT CO<sub>2</sub>e/yr)

Fuel Type	Brawley-IVC Route Emissions	Calexico-IVC Route Emissions	Total Bus Emissions
Diesel	162.41	200.65	363.06
CNG	139.54	172.40	311.94
Electric	39.57	48.89	88.46
Hydrogen	87.91	108.60	196.51

Table 9 presents the total net change in emissions for the different routes in Phase 1 based on the change in bus emissions and the corresponding VMT reduction in passenger vehicles. Consistent with the results in Table 1, electric buses would result in the most substantial reduction in GHG emissions at 196 MT CO<sub>2</sub>e per year.

Table 9 – Phase 1 Net Change in Emissions (MT CO<sub>2</sub>e/yr)

Fuel Type	Brawley-IVC Route	Calexico-IVC Route	Total Net Change in Emissions
Diesel	33.59	45.17	78.76
CNG	10.73	16.92	27.64
Electric	-89.25	-106.60	-195.85
Hydrogen	-40.91	-46.88	-87.79

Table 10 presents the annual GHG emissions for the different transit fuel types for Phase 2 of the project. Similar to the results of Phase 1, diesel and CNG buses would result in the largest net increase in GHG emissions. Electric buses would result in the lowest level of GHG emissions.

Table 10 – Phase 2 Bus Emissions (MT CO<sub>2</sub>e/yr)

Fuel Type	Brawley-IVC Route	Calexico-IVC Route	SDSU Calexico-Brawley Route	Total Bus Emissions
Diesel	162.41	200.65	193.56	556.62
CNG	139.54	172.40	166.31	478.25
Electric	39.57	48.89	47.16	135.62
Hydrogen	87.84	108.52	104.69	301.06

Table 11 presents the total net change in emissions for the different routes in Phase 2 based on the change in bus emissions and the corresponding VMT reductions in passenger vehicles. Similar to Phase 1, electric buses operating in Phase 2 would result in the most substantial reduction in GHG emissions. Hydrogen buses would also result in a net reduction in GHG emissions. Diesel and CNG buses would result in an overall net increase in annual GHG emissions. Based on the overall distance, annual ridership, and vehicle trips, the SDSU-Calexico/SDSU-Brawley Route would result in a net reduction in GHG emissions for all fuel types.

Table 11 – Phase 2 Net Change in Emissions (MT CO<sub>2</sub>e/yr)

Fuel Type	Brawley-IVC Route	Calexico-IVC Route	SDSU Calexico-Brawley Route	Total Net Change
Diesel	74.89	130.21	-93.97	111.13
CNG	52.02	101.96	-121.22	32.76
Electric	-47.95	-21.55	-240.37	-309.87
Hydrogen	0.32	38.09	-182.84	-144.43

## 24.0 SUMMARY OF RECOMMENDED PLAN

This section of the report presented the recommended plan for the proposed academic shuttle service, with service metrics presented by phase. A total of three new routes would be implemented over two primary phases; it is anticipated that these services would operate only during the academic year. The greenhouse gas (GHG) emission benefits of the transit service depend on the fuel types. Both diesel and compressed natural gas (CNG) bus engines result in an annual net increase in GHG emissions in Phase 1. Electric and hydrogen buses result in a net annual decrease in GHG emissions when considering the replacement of VMT from passenger vehicles. The SDSU-Calexico/SDSU-Brawley Express Route would result in a net reduction in GHG emissions for all fuel types in Phase 2.

This recommended plan will also be evaluated as part of the upcoming Short Range Transit Plan (SRTP) to be prepared by the Imperial County Transportation Commission.

## Appendix A Outreach Efforts

Outreach Schedules .....	98
Fact Sheets in English and Spanish .....	100

## OUTREACH SCHEDULES

### First Round of Outreach – Overview of Community Participation Options

Participation Opportunity	Focus	Number of Participants
Passenger and Campus Questionnaires	To understand current transit use/experience and potential transit needs of the college communities, brief questionnaires were administered in-person, online, and via text on campus and at or near campus-serving bus stops.	
	<u>Wednesday, November 18, 2015</u>	
	<i>Imperial Valley College 12:00 p.m. to 2:00 p.m.</i>	38
	<i>San Diego State University-Calexico Bus Stop 2:30 p.m. to 4:00 p.m.</i>	38
	<i>San Diego State University-Brawley 5:00 p.m. to 7:00 p.m.</i>	
	<u>Thursday, November 19, 2015</u>	
	<i>Imperial Valley College Bus Stop 9:00 a.m. to 11:00 a.m.</i>	56
	<i>San Diego State University-Calexico 3:00 p.m. to 5:00 p.m.</i>	40
Bilingual Public Workshops	Workshops with interactive discussions and visual activities were conducted in an informal “pop-up” setting in popular student gathering areas.	
	<u>Wednesday, November 18, 2015</u>	
	<i>SDSU-Calexico 5:00 p.m. to 7:00 p.m.</i>	44
	<u>Thursday, November 19, 2015</u>	
	<i>IVC 12:00 p.m. to 2:00 p.m.</i>	37
	<i>SDSU-Brawley 3:00 p.m. to 5:00 p.m.</i>	32
Post-Outreach Availability of Questionnaire November 20 – December 1, 2015		22
TOTAL PARTICIPANTS		307



## Second Round of Outreach – Overview of Community Participation Options

Tuesday, April 19, 2016		
Location	Time	Number of Participants
Imperial Valley College, Bus Stop	11:30AM – 2:00PM	24
Imperial Valley College, Building 2700	11:30AM – 2:00PM	66
SDSU-Calexico, Main Quad	3:30PM – 6:00PM	24
SDSU-Brawley, Main Lobby	3:30PM – 6:00PM	4
	Total Participants	118

## FACT SHEETS IN ENGLISH AND SPANISH



### WANT BUS SERVICE BETWEEN YOUR COLLEGE CAMPUSES?

**Come Out and Tell Us  
What You Think!**

Look for us on **Wednesday, November 18** and **Thursday, November 19, 2015** on your college campus.

We'll have free giveaways and we'll be looking for your feedback on campus bus service.

**What is the Imperial Valley College/San Diego State University Transit Study?**  
The purpose of this study is to recommend improvements to transit access to three college campuses in the Imperial Valley (Imperial Valley College, San Diego State University – Brawley, and San Diego State University – Calexico). These improvements may include creating a new transit shuttle service that serves the three colleges and/or leveraging existing bus service.

More Info at:

[www.imperialctc.org/  
campus-transit-study](http://www.imperialctc.org/campus-transit-study)

This study is a collaborative effort between Imperial County Transportation Commission (ICTC), Imperial Valley College (IVC), San Diego State University – Imperial Valley (SDSU-IV) and the Southern California Association of Governments (SCAG).

Individuals wishing accessibility accommodations at these events, under the Americans with Disabilities Act (ADA), may request such accommodations to aid hearing, visual, or mobility impairment by contacting ICTC offices at (760) 592-4494. Please note that 48 hours advance notice will be necessary.







English Fact sheet from first round of outreach



### ¿QUIERE UN SERVICIO DE BUSES ENTRE LOS CAMPUS UNIVERSITARIOS?

**¡Acérquese y díganos  
que opina!**

Búsquenos **martes, el 19 de abril** en su campus universitario.

Tendremos premios gratis, estaremos esperando por sus comentarios sobre el posible servicio de buses en el futuro.

**¿Cuál es el propósito del Estudio de Tránsito para Imperial Valley College/San Diego State University?**  
El propósito de este estudio es el recomendar mejoras para tener acceso a Imperial Valley (Imperial Valley College, San Diego State University – Brawley, y San Diego State University – Calexico). Estas mejoras pueden incluir el crear un nuevo servicio de tránsito entre las tres universidades y/o impulsar el servicio de buses existente. Venga al taller comunitario y díganos cuál es su opinión con respecto a las posibles rutas de bus en el futuro.

Para más información visítanos en:

[www.imperialctc.org/  
campus-transit-study](http://www.imperialctc.org/campus-transit-study)

Este estudio es un esfuerzo conjunto entre Imperial County Transportation Commission (ICTC), Imperial Valley College (IVC), San Diego State University – Imperial Valley (SDSU-IV) y Southern California Association of Governments (SCAG).

Bajo el Americans with Disabilities Act (ADA), las personas que requieran asistencia en estos eventos, pueden solicitar ayuda para asistencia auditiva, visual o movilidad reducida contactando las oficinas de ICTC al (760) 592-4494. Por favor tome en cuenta que el servicio necesita ser solicitado con 48 horas de anticipación.







Spanish Fact sheet from second round of outreach

## Appendix B Outreach Questions

Questionnaire .....	102
Guiding Questions .....	104

## QUESTIONNAIRE

The questionnaire was only distributed during the first round of outreach in order to gather public input on existing transit use patterns.

The following questions were posed in-person, online, and via text in English and Spanish:

1	Want bus service between your college campuses? a. Yes b. No c. Maybe		
2	Do you usually take the bus to college? a. Yes b. No *Answer question 2b if response is b	2b	Why not? a. Doesn't go to my campus b. Inconvenient pickup/dropoff c. Expensive d. Confusing routes e. I drive f. Easy parking g. Other
3	Which campus do you usually visit most? a. SDSU-Brawley b. SDSU-Calexico c. Imperial Valley College		
4	Where else do you go? a. SDSU-Brawley b. SDSU-Calexico c. Imperial Valley College d. All of the campuses e. I don't go to other campuses *Answer question 4b if response is a, b, c, or d	4b	How often do you go? a. Once a week b. Twice a week c. 3 or 4 times a week d. 5 times a week e. More than 5 times a week
5	Do you have access to a car, or other ways of getting to campus? a. Yes b. No		
6	What best describes your current status: a. College student b. College instructor c. College staff d. None of the above *Answer question 6b if response is a	6b	Are you cross-enrolled at IVC and SDSU? a. Yes b. No

1	¿Te gustaría un servicio de autobuses entre los diferentes campus universitarios? a. Sí b. No c. Tal vez		
2	2. ¿Usualmente tomas el autobús para ir a la Universidad? a. Sí b. No *Answer question 2b if response is b	2b	¿Por qué no? a. No va a mi campus b. Tiempo es inconveniente c. Es Caro d. Rutas son confusas e. Yo manejo f. Fácil aparcar g. Otro
3	¿A qué campus universitario vas más seguido? a. SDSU-Brawley b. SDSU-Calexico c. Imperial Valley College		
4	¿Vas a otro campus? a. SDSU-Brawley b. SDSU-Caléxico c. Imperial Valley College d. Todos los campus e. No voy a ningún otro campus *Answer question 4b if response is a, b, c, or d	4b	¿Con qué frecuencia vas? a. a. 1 vez/semana b. 2 veces/semana c. 3 o 4 veces/semana d. 5 veces/semana e. Más de 5 veces/semana
5	¿Tienes acceso a carro u otras maneras diferentes de llegar al campus? a. Sí b. No		
6	¿Cuál describe de mejor manera tu situación actual? a. Estudiante b. Instructor c. Personal universitario d. Ninguno de los anteriores *Answer question 6b if response is a	6b	¿Estás registrado bajo doble matrícula (dual-enrollment) en IVC y SDSU? a. Sí b. No

## GUIDING QUESTIONS

The following questions were asked during one-on-one conversations with workshop participants to guide conversations:

### First Round of Outreach

- How important is public transit to the college community?
- Is there room for improvement for the current transit system?
- What does your schedule look like?
- Are there any constraints to your coursework due to transit?

### Second Round of Outreach

- Would you use these bus routes?
- How often should the shuttle run?
- Any suggestions?





## Appendix C

### Outreach Results

Results from First Round of Outreach .....	106
Results from Second Round of Outreach .....	108

## RESULTS FROM FIRST ROUND OF OUTREACH

### Summary of Intercampus Travel Charts by Event

Number of Participants Who Travel			
	0		2 to 5
	1		6 +

FROM > TO	Morning	Afternoon	Evening	Sub-Total
Brawley > Calexico	4	36	11	51
Brawley > IVC	0	2	1	3
Calexico > Brawley	0	5	7	12
Calexico > IVC	4	5	8	17
IVC > Brawley	0	0	0	0
IVC > Calexico	0	12	1	13
			TOTAL	96

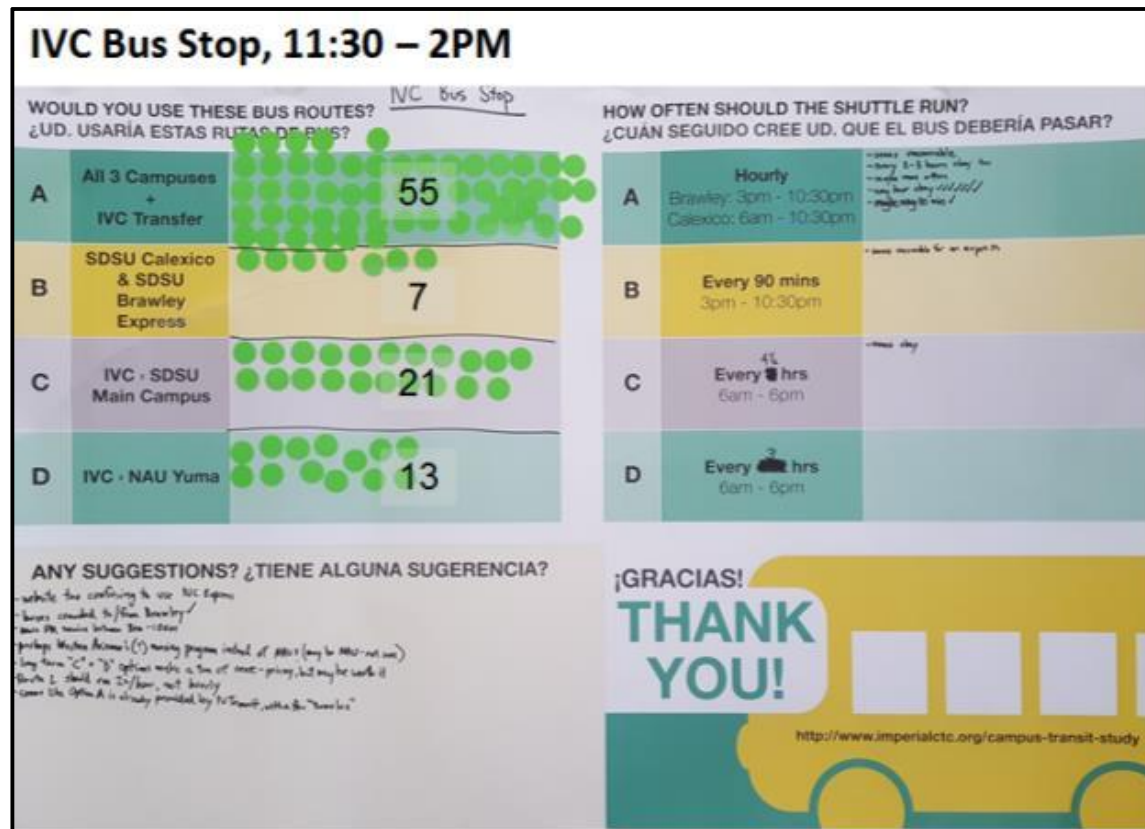


## Questionnaire Completion Counts

	11/18	11/19	11/20 – 12/01	TOTAL
English	91	135	20	246
Spanish	29	30	2	61
Daily Totals	120	165	22	307

Question	Responses	Totals	%	Total Responses	Completeness
Want bus service b/w college campuses?	Yes	280	91.21%	307	100.00%
	No	15	4.89%		
	Maybe	12	3.91%		
Do you usually take the bus to college?	Yes	47	18.80%	250	81.43%
	No	203	81.20%		
Why not?	Doesn't go to my campus	11	5.45%	202	80.80%
	Inconvenient pickup/dropoff	4	1.98%		
	Expensive	0	0.00%		
	Confusing routes	7	3.47%		
	I drive	149	73.76%		
	Easy parking	2	0.99%		
	Other	29	14.36%		
Which campus do you visit most?	SDSU-Brawley	15	4.90%	306	99.67%
	SDSU-Calexico	135	44.12%		
	IVC	156	50.98%		
Where else do you go?	SDSU-Brawley	56	18.36%	305	99.35%
	SDSU-Calexico	43	14.10%		
	IVC	29	9.51%		
	All campuses	20	6.56%		
	I don't go to other campuses	157	51.48%		
How often do you go?	1/wk	54	36.73%	147	99.32%
	2/wk	30	20.41%		
	3 or 4/wk	48	32.65%		
	5/wk	6	4.08%		
	5+/wk	9	6.12%		
Do you have access to a car, or other ways of getting to campus?	Yes	232	76.82%	302	98.37%
	No	70	23.18%		
What best describes your current status?	College student	295	97.68%	302	98.37%
	College instructor	2	0.66%		
	College staff	2	0.66%		
	None	3	0.99%		
Are you cross-enrolled at IVC and SDSU?	Yes	62	21.02%	295	100.00%
	No	233	78.98%		
					95.26%

## RESULTS FROM SECOND ROUND OF OUTREACH



### IVC, Bldg 2700 11:30 – 2PM

WOULD YOU USE THESE BUS ROUTES?  
¿UD. USARÍA ESTAS RUTAS DE BUS?

A	All 3 Campuses + IVC Transfer	133
B	SDSU Calexico & SDSU Brawley Express	19
C	IVC - SDSU Main Campus SAN DIEGO	82
D	IVC - NAU Yuma	30

HOW OFTEN SHOULD THE SHUTTLE RUN?  
¿CUÁN SEGUIDO CREE UD. QUE EL BUS DEBERÍA PASAR?

A	Hourly Brawley: 3pm - 10:30pm Calexico: 6am - 10:30pm	Handwritten: Hourly, 10:30am - 7:00pm, 10:30am - 7:00pm, 10:30am - 7:00pm
B	Every 90 mins 3pm - 10:30pm	Handwritten: 90mins to go from Brawley to IVC, 10:30am - 7:00pm, 10:30am - 7:00pm, 10:30am - 7:00pm
C	Every 1 1/2 hrs 6am - 6pm	Handwritten: Every three hours, 10:30am - 7:00pm, 10:30am - 7:00pm, 10:30am - 7:00pm
D	Every 3 hrs 6am - 6pm	Handwritten: Every 3 hrs, 10:30am - 7:00pm, 10:30am - 7:00pm, 10:30am - 7:00pm

ANY SUGGESTIONS? ¿TIENE ALGUNA SUGERENCIA?

Handwritten: The person will not bus come to pick up at IVC every hour to go to the IVC campus  
Route A create space for a bus stop  
For bus system students pay a fee of \$5 for the whole journey  
SDSU express going from Brawley to Calexico to San Diego (leave 11:30) leave every 4-5 hrs  
The IVC stop is more convenient than other IVCs will (only near San)

¡GRACIAS! THANK YOU!

<http://www.imperialctc.org/campus-transit-study>

### SDSU-Brawley, 3:30 – 6PM

WOULD YOU USE THESE BUS ROUTES?  
¿UD. USARÍA ESTAS RUTAS DE BUS?

A	All 3 Campuses + IVC Transfer	4
B	SDSU Calexico & SDSU Brawley Express	7
C	IVC - SDSU Main Campus	3
D	IVC - NAU Yuma	2

HOW OFTEN SHOULD THE SHUTTLE RUN?  
¿CUÁN SEGUIDO CREE UD. QUE EL BUS DEBERÍA PASAR?

A	Hourly Brawley: 3pm - 10:30pm Calexico: 6am - 10:30pm	Handwritten: Every hour reasonable
B	Every 90 mins 3pm - 10:30pm	
C	Every 1 1/2 hrs 6am - 6pm	
D	Every 3 hrs 6am - 6pm	

ANY SUGGESTIONS? ¿TIENE ALGUNA SUGERENCIA?

Handwritten: SDSU Brawley Campus

¡GRACIAS! THANK YOU!

<http://www.imperialctc.org/campus-transit-study>

