TRB WEBINAR:
HIGHWAY PERFORMANCE MONITORING
SYSTEM TRAVEL TIME DATA PROCESSING

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Moderated by Dan Seedah, PhD, PE
WEBINAR OUTLINE

- Describe NPMRDS
- Getting NPMRDS travel time data
- Quality of Travel Time Data : Local comparison
- NPMRDS TMC’s & LRS
- NPMRDS Local Repository
- HPMS Export Data Items Generation
- Travel Time Visualizations
TRAFFIC MESSAGE CHANNEL (TMC)

Traffic Message Channel (TMC) Code

- **Country Code**
- **Internal/External Path and Direction**
- **Location Table Name**
- **Location ID**

```
"P" = Northbound or Westbound, internal segments
"N" = Southbound or Eastbound, internal segments
"+" = Northbound or Westbound, external segments
"-" = Southbound or Eastbound, external segments
```
NPMRDS - NATIONAL PERFORMANCE MANAGEMENT RESEARCH DATASET

- Archived travel time and speed
- 5 Minute Interval
- Covers the NHS
- Two Vehicle Types: Truck and Passenger
NPMRDS - NATIONAL PERFORMANCE MANAGEMENT RESEARCH DATASET

- TMC Shapefile available at [https://npmrds.ritis.org](https://npmrds.ritis.org)
- TMC Identification table (.csv)
- Speed/travel time data table (.csv)
GETTING NPMRDS DATA

- Sign up for an account at npmrds.ritis.org
## HAWAIIAN ISLANDS NPMRDS COVERAGE MAP TMC COUNTS

<table>
<thead>
<tr>
<th>Island</th>
<th>TMCs 2018</th>
<th>TMCs 2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hawaii</td>
<td>128</td>
<td>94</td>
</tr>
<tr>
<td>Kauai</td>
<td>63</td>
<td>68</td>
</tr>
<tr>
<td>Maui</td>
<td>122</td>
<td>134</td>
</tr>
<tr>
<td>Oahu</td>
<td>817</td>
<td>815</td>
</tr>
<tr>
<td>No.</td>
<td>TMC Fields</td>
<td>No.</td>
</tr>
<tr>
<td>-----</td>
<td>------------------</td>
<td>-----</td>
</tr>
<tr>
<td>1</td>
<td>tmc</td>
<td>20</td>
</tr>
<tr>
<td>2</td>
<td>road</td>
<td>21</td>
</tr>
<tr>
<td>3</td>
<td>direction</td>
<td>22</td>
</tr>
<tr>
<td>4</td>
<td>intersection</td>
<td>23</td>
</tr>
<tr>
<td>5</td>
<td>state</td>
<td>24</td>
</tr>
<tr>
<td>6</td>
<td>county</td>
<td>25</td>
</tr>
<tr>
<td>7</td>
<td>zip</td>
<td>26</td>
</tr>
<tr>
<td>8</td>
<td>start_latitude</td>
<td>27</td>
</tr>
<tr>
<td>9</td>
<td>start_longitude</td>
<td>28</td>
</tr>
<tr>
<td>10</td>
<td>end_latitude</td>
<td>29</td>
</tr>
<tr>
<td>11</td>
<td>end_longitude</td>
<td>30</td>
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<td>12</td>
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<td>15</td>
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<td>16</td>
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<td>tmclinear</td>
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<tr>
<td>18</td>
<td>frc</td>
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<td>border_set¹</td>
<td>38</td>
</tr>
<tr>
<td></td>
<td></td>
<td>39</td>
</tr>
</tbody>
</table>
## Field Name | Description
--- | ---
datasource | Indicates all vehicles, passenger vehicles, or trucks.
tmc_code | The unique 9-digit value identifying the TMC segment.
measurement_timestamp | Date and time of data recorded
speed | Observed average speed in mph for a time interval
average_speed | The historical average speed for the roadway segment for that hour of the day and day of the week in miles per hour.
reference_speed | The calculated "free flow" mean speed for the roadway segment in miles per hour. This attribute is calculated based upon the 85th-percentile point of the observed speeds on that segment for all time periods.
travel_time | Corresponds to the “speed” field; in minutes (or seconds)
data_density | Data density indicator, where: A = 1 to 4 reporting vehicles, B = 5 to 9 reporting vehicles, C = 10 or more reporting vehicles
## TRAFFIC MESSAGE CHANNEL (TMC)

<table>
<thead>
<tr>
<th>tmc</th>
<th>road</th>
<th>direction</th>
<th>intersection</th>
<th>state</th>
<th>county</th>
<th>zip</th>
<th>start_latitude</th>
<th>start_longitude</th>
<th>end_latitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>126-04201</td>
<td>HI-61</td>
<td>SOUTHBOUND</td>
<td>PAUOA RD</td>
<td>HI</td>
<td>HONOLULU</td>
<td>96813</td>
<td>21.326010</td>
<td>-157.845360</td>
<td>21.319880</td>
</tr>
<tr>
<td>126+04201</td>
<td>HI-61</td>
<td>NORTHBOUND</td>
<td>PAUOA RD</td>
<td>HI</td>
<td>HONOLULU</td>
<td>96813</td>
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<td>-157.851700</td>
<td>21.318300</td>
</tr>
<tr>
<td>126+04201</td>
<td>HI-61</td>
<td>EASTBOUND</td>
<td>PAUOA RD</td>
<td>HI</td>
<td>HONOLULU</td>
<td>96813</td>
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<td>-157.851642</td>
<td>21.320012</td>
</tr>
<tr>
<td>126+04202</td>
<td>HI-61</td>
<td>NORTHBOUND</td>
<td>NUUANU AVE/WYLLIE ST</td>
<td>HI</td>
<td>HONOLULU</td>
<td>96813</td>
<td>21.321870</td>
<td>-157.847440</td>
<td>21.327330</td>
</tr>
<tr>
<td>126+04204</td>
<td>HI-61</td>
<td>NORTHBOUND</td>
<td>ULUHALA ST</td>
<td>HI</td>
<td>HONOLULU</td>
<td>96734</td>
<td>21.374910</td>
<td>-157.780740</td>
<td>21.379560</td>
</tr>
</tbody>
</table>
TRAFFIC MESSAGE CHANNEL (TMC) & LINEAR REFERENCING
TRAFFIC MESSAGE CHANNEL (TMC) & LINEAR REFERENCING
# R Helper functions

==

# Install and load all packages provided from a character vector

load_pkgs = function(pkgs) {
    new_pkgs = pkgs[!(pkgs %in% installed.packages()[, 'Package'])]
    if (length(new_pkgs) > 0) install.packages(new_pkgs)
    invisible(lapply(pkgs, function(x)
        suppressMessages(library(x, character.only = TRUE)))
    )
}
CONNECT TO DATABASE

# list of helpful packages to load

libs <-
c("rgdal","spatial","MASS","dplyr","tidyr","cluster","ggmap","tmap","shiny","data.table","lubridate","RSQLite","maptools","sp","spatial","DBI","RODBC")
CONNECT TO DATABASE AND READ NPMRDS DATA

- `dbCon <- dbConnect(SQLite(), dbname = "HPMS/Traffic/NPMRDS/rnpmrds.sqlite", loadable.extensions = TRUE, cache_size = NULL, synchronous = "off", flags = SQLITE_RW, vfs = NULL)`

- `paliebwdpre2pospm <- as.data.table(dbReadTable(dbCon, "paliebwdpre2pospm", row.names=NULL, check.names = TRUE))`
PERIOD LEVEL TRAVEL TIME DATA

# Generate the period level travel time data

- Select the HPMS distinct period data using the time stamp (TStamp Field) for trucks and all vehicles.

# Weekday AM

- \[\text{ttam17} \leftarrow \text{NPMRDSTT}\left[(\text{wday(TStamp)}>1 \& \text{wday(TStamp)}<7) \& (\text{hour(TStamp)} \geq 6 \& \text{hour(TStamp)} <10)\right]\]

- \[\text{ttrakam17} \leftarrow \text{NPMRDSTTRK}\left[(\text{wday(TStamp)}>1 \& \text{wday(TStamp)}<7) \& (\text{hour(TStamp)} \geq 6 \& \text{hour(TStamp)} <10)\right]\]

# Weekday Midday

- \[\text{ttmid17} \leftarrow \text{NPMRDSTT}\left[(\text{wday(TStamp)}>1 \& \text{wday(TStamp)}<7) \& (\text{hour(TStamp)} \geq 10 \& \text{hour(TStamp)} <16)\right]\]

- \[\text{trkmid17} \leftarrow \text{NPMRDSTTRK}\left[(\text{wday(TStamp)}>1 \& \text{wday(TStamp)}<7) \& (\text{hour(TStamp)} \geq 10 \& \text{hour(TStamp)} <16)\right]\]

[Adapted from FHWA - CPI Manual 2001]
# Generate the period level travel time data

### Weekday PM
- `ttpm17 <- NPMRDSTT[(wday(TStamp)>1 & wday(TStamp)<7) & (hour(TStamp) >= 16 & hour(TStamp) <20)]`
- `trkpm17 <- NPMRDSTTRK[(wday(TStamp)>1 & wday(TStamp)<7) & (hour(TStamp) >= 16 & hour(TStamp) <20)]`

### Weekend
- `ttwkend17 <- NPMRDSTT[!(wday(TStamp)>1 & wday(TStamp)<7) & (hour(TStamp) >= 6 & hour(TStamp) <20)]`
- `trkwkend17 <- NPMRDSTTRK[!(wday(TStamp)>1 & wday(TStamp)<7) & (hour(TStamp) >= 6 & hour(TStamp) <20)]`

### Weekday Nite (Truck Only)
- `trknite17 <- NPMRDSTTRK[(wday(TStamp)>1 & wday(TStamp)<7) & !(hour(TStamp) >= 6 & hour(TStamp) <20)]`

[Adapted from FHWA - CPI Manual 2001]
# Generate the 50th, 80th, 95th percentile speed and travel time summary data for each period by TMC

**# Weekday AM**

- $\texttt{ttamq17} \leftarrow \texttt{ttam17}[,.(\texttt{ttq50}=\texttt{quantile(TTSecs,probs=0.5)}, \texttt{ttq80}=\texttt{quantile(TTSecs,probs=0.8)}, \texttt{spq50}=\texttt{quantile(speed,probs=0.5)}, \texttt{spq80}=\texttt{quantile(speed,probs=0.8)}, \texttt{rspq50}=\texttt{quantile(RefSpd,probs=0.5,na.rm=TRUE)}), \texttt{by=tmc\_code}]$

- $\texttt{trkamq17} \leftarrow \texttt{trkam17}[,.(\texttt{ttq50}=\texttt{quantile(TTSecs,probs=0.5)}, \texttt{ttq95}=\texttt{quantile(TTSecs,probs=0.95)}, \texttt{spq50}=\texttt{quantile(speed,probs=0.5)}, \texttt{spq95}=\texttt{quantile(speed,probs=0.95)}, \texttt{rspq50}=\texttt{quantile(RefSpd,probs=0.5,na.rm=TRUE)}), \texttt{by=tmc\_code}]$

[Adapted from FHWA - CPI Manual 2001]
# Generate the 50th, 80th, 95th percentile speed and travel time summary data for each period by TMC

# Weekday Midday

- `ttmidq17 <- ttmid17[, .(ttq50=quantile(TTSecs,probs=0.5),
  ttq80=quantile(TTSecs,probs=0.8),
  spq50=quantile(speed,probs=0.5),
  spq80=quantile(speed,probs=0.8),
  rspq50=quantile(RefSpd,probs=0.5,na.rm=TRUE)), by=tmc_code]`

- `trkmidq17 <- trkmid17[, .(ttq50=quantile(TTSecs,probs=0.5),
  ttq95=quantile(TTSecs,probs=0.95),
  spq50=quantile(speed,probs=0.5),
  spq95=quantile(speed,probs=0.95),
  rspq50=quantile(RefSpd,probs=0.5,na.rm=TRUE)), by=tmc_code]`
# Weekday PM

- `ttpmq17 <- ttpm17[, .(ttq50=quantile(TTSecs,probs=0.5),
  ttq80=quantile(TTSecs,probs=0.8),
  spq50=quantile(speed,probs=0.5),
  spq80=quantile(speed,probs=0.8),
  rspq50=quantile(RefSpd,probs=0.5,na.rm=TRUE)), by=tmc_code]`

- `trkpmq17 <- ttpm17[, .(ttq50=quantile(TTSecs,probs=0.5),
  ttq95=quantile(TTSecs,probs=0.95),
  spq50=quantile(speed,probs=0.5),
  spq95=quantile(speed,probs=0.95),
  rspq50=quantile(RefSpd,probs=0.5,na.rm=TRUE)), by=tmc_code]`
# Weekend

```
ttwkendq17 <- ttwkend17 [, .(ttq50 = quantile(TTSecs,probs=0.5),
                                ttq80=quantile(TTSecs,probs=0.8),
                                spq50=quantile(speed,probs=0.5),
                                spq80=quantile(speed,probs=0.8),
                                rspq50=quantile(RefSpd,probs=0.5,na.rm=TRUE)), by=tmc_code]
```

```
trkwkendq17 <- trkwkend17 [, .(ttq50 = quantile(TTSecs,probs=0.5),
                                ttq95=quantile(TTSecs,probs=0.95),
                                spq50=quantile(speed,probs=0.5),
                                spq95=quantile(speed,probs=0.95),
                                rspq50=quantile(RefSpd,probs=0.5,na.rm=TRUE)), by=tmc_code]
```

# Weekday Nite (Truck Only)

```
trkniteq17 <- trknite17[, .(ttq50=quantile(TTSecs,probs=0.5),
                          ttq95=quantile(TTSecs,probs=0.95),
                          spq50=quantile(speed,probs=0.5),
                          spq95=quantile(speed,probs=0.95),
                          rspq50=quantile(RefSpd,probs=0.5,na.rm=TRUE)), by=tmc_code]
```
Write to SQLite database from R

# Write result tables into database
- `dbWriteTable(dbCon,"HINPMRDSTTAMQ17", ttamq17)`
- `dbWriteTable(dbCon,"HINPMRDSTTMIDQ17", ttomidq17)`
- `dbWriteTable(dbCon,"HINPMRDSTTPMQ17", ttpmq17)`
- `dbWriteTable(dbCon,"HINPMRDSTRKAMQ17", trkamq17)`
- `dbWriteTable(dbCon,"HINPMRDSTRKMKIDQ17", trkmidq17)`
- `dbWriteTable(dbCon,"HINPMRDSTRKPMIDQ17", trkpmq17)`
DATABASE PM3 MEASURE GENERATION
NPMRDS’ FOUR PM3 MEASURES

Reliability
- Percent of person-miles traveled on the Interstate that are reliable
- Percent of person-miles traveled on the non-Interstate NHS that are reliable

Freight
- Truck Travel Time Reliability (TTTR) Index
- CMAQ Peak Hour Excessive Delay (PHED)
- Annual Hours of PHED Per Capita
### SUMMARY OF PM3 TRAVEL TIME BASED MEASURES

#### Summary of Travel Time Based 4 Measures

<table>
<thead>
<tr>
<th>Measure</th>
<th>Applicability</th>
<th>If NPMRDDS Used</th>
<th>Metrics to HPMS by 6/15/2018</th>
<th>State to Set Targets by 5/20/2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reliability – Interstate</td>
<td>Mainline Interstate</td>
<td>“All Vehicle”, 15-minute</td>
<td>LOTTR (=80&lt;sup&gt;th&lt;/sup&gt; TT/50&lt;sup&gt;th&lt;/sup&gt; TT)</td>
<td>2-year, 4 -year</td>
</tr>
<tr>
<td>Reliability – Non- Interstate NHS</td>
<td>Mainline non- Interstate NHS</td>
<td>“All Vehicle”, 15-minute</td>
<td>LOTTR (=80&lt;sup&gt;th&lt;/sup&gt; TT/50&lt;sup&gt;th&lt;/sup&gt; TT)</td>
<td>4-year</td>
</tr>
<tr>
<td>Freight</td>
<td>Mainline Interstate</td>
<td>“Truck” (use “All Vehicle” if “Truck” not available), 15-minute</td>
<td>TTTR = (95&lt;sup&gt;th&lt;/sup&gt; TT/50&lt;sup&gt;th&lt;/sup&gt; TT)</td>
<td>2-year, 4 -year</td>
</tr>
<tr>
<td>PHED</td>
<td>Mainline NHS in applicable Urbanized Area</td>
<td>“All Vehicle”, 15-minute</td>
<td>Total PHED in person-hours</td>
<td>4-year</td>
</tr>
</tbody>
</table>
Create table HINPMRDS2017AMPK as

FROM HINPMRDSSTTAMQ17 t1, HINPMRDS2017 t2
where t1.TMC_Code = t2.TMC
ORDER BY t2.AltRteName, t1.tmc_Code;
Create table HINPMRDS2017Miday as


FROM HINPMRDSSTTIMIDQ17 t1, HINPMRDS2017 t2

where t1.TMC_Code = t2.TMC

ORDER BY t2.AltRteName, t1.tmc_Code;
Create table HINPMRDS2017PMPK as


FROM HINPMRDSSTTPMQ17 t1, HINPMRDS2017 t2

where t1.TMC_Code = t2.TMC

ORDER BY t2.AltRteName, t1.tmc_Code;
Create table HINPMRDS2017WKEND as


FROM HINPMRDSSTTWKENDQ17 t1, HINPMRDS2017 t2 where t1.TMC_Code = t2.TMC

ORDER BY t2.AltRteName, t1.tmc_Code;
create View VWHINPMRDS2017TTPM3 as

SELECT 2017 yr, t0.Tmc, t0.TmcType, t0.RoadNumber, t0.RoadName, t0.IsPrimary, t0.FirstName, t0.TmcLinear, t0.Country, t0.State, t0.County, t0.Zip, t0.Direction, t0.StartLat, t0.StartLong, t0.EndLat, t0.EndLong, t0.Miles, t0.FRC, t0.Border_Set, t0.Funsystem, t0.Urban_Code, t0.FacilType, t0.StrucType, t0.ThruLanes, t0.Route_Numb, t0.Route_Sign, t0.Route_Qual, t0.AltRteName, t0.AADT, t0.AADTSing, t0.AADTComb, t0.NHS, t0.NHS_Pct, t0.STRHNETYPE, t0.STRHNETPCT, t0.Truck, (t0.MILES*t0.AADT *365) VMT, t0.Shape, round(t1.ttq50) TT_AMP50PCT, round(t1.ttq80) TT_AMP80PCT, round(t1.ttq80/(nullif(t1.ttq50,0)),2) LOTTR_Amp, round(t1.spq50) TTAMSP50, round(t1.spq80) TTAMSP80, round(t1.rspq50) TTAMRSP50, round(t2.ttq50) TT_MIDD50PCT, round(t2.ttq80) TT_MIDD80PCT, round(t2.ttq80/(nullif(t2.ttq50,0)),2) LOTTR_MIDD, round(t2.spq50) TTMISPDP50, round(t2.rspq50) TTMIRSPDP50, round(t3.ttq50) TT_PMP50PCT, round(t3.ttq80) TT_PMP80PCT, round(t3.ttq80/(nullif(t3.ttq50,0)),2) LOTTR_PMP, round(t3.spq50) TTPMSPDP50, round(t3.spq80) TTPMSPDP80, round(t3.rspq50) TTPMRSPDP50, round(t5.ttq50) TT_WE50PCT, round(t5.ttq80) TT_WE80PCT, round(t5.ttq80/(nullif(t5.ttq50,0)),2) LOTTR_WE, round(t5.spq50) TTWESPD50, round(t5.spq80) TTWESPD80, round(t5.rspq50) TTWERSPD50

FROM HINPMRDS2017 t0, HINPMRDSSTAMQ17 t1, HINPMRDSSTTMIDQ17 t2, HINPMRDSSTTPMQ17 t3, HINPMRDSSTTWKENDQ17 t5

where t0.tmc = t1.tmc_code(+) and t1.tmc_code = t2.tmc_code(+) and t2.tmc_code = t3.tmc_code(+) and t3.tmc_code = t5.tmc_code(+)

ORDER BY t0.AltRteName , t0.tmc;
Create Table HINPMRDS2017TTPM3 as

SELECT 2017 yr, t0.Tmc, t0.TmcType, t0.RoadNumber, t0.RoadName,
t0.IsPrimary, t0.FirstName, t0.TmcLinear, t0.Country, t0.State, t0.County,
t0.Zip, t0.Direction, t0.StartLat, t0.StartLong, t0.EndLat, t0.EndLong,
t0.Miles, t0.FRC, t0.Border_Set, t0.Funsystem, t0.Urban_Code, t0.FacilType,
t0.StrucType, t0.ThruLanes, t0.Route_Numb, t0.Route_Sign, t0.Route_Qual,
t0.AltRteName, t0.AADT, t0.AADTSing, t0.AADTComb, t0.NHS, t0.NHS_Pct,
t0.STRHNETYPE, t0.STRHNETPCT, t0.Truck, t0.Shape, t0.TT_AMPS50PCT,
t0.TT_AMPS80PCT, t0.LOTTR_Amp, t0.TTAMSP50, t0.TTAMSP80,
t0.TTAMRSP50, t0.TT_MIDD50PCT, t0.TT_MIDD80PCT, t0.LOTTR_MIDD,
t0.TTMISPD50, t0.TTMISPD80, t0.TTMIRSPD50, t0.TT_PMP50PCT,
t0.TT_PMP80PCT, t0.LOTTR_PMP, t0.TTPMSPD50, t0.TTPMSPD80,
t0.TTPMRSPD50, t0.TT_WE50PCT, t0.TT_WE80PCT, t0.LOTTR_WE,
t0.TTWESPD50, t0.TTWESPD80, t0.TTWERSPD50

FROM VWHINPMRDS2017TTPM3 t0

ORDER BY t0.AltRteName, t0.tmc;
NPMRDS SPEED DATA COMPARISON
HAWAII DOT COUNT STATIONS

HI DOT Count Stations

Permanent Stations
PERMANENT STATIONS SPEED COMPARISON

- Station H13P – on Interstate H-2 at mile point 4.02
- Station C7L – on Interstate H-1 at mile point 11.74
- Station SL71 – on Interstate H-1 at Ward Avenue exit at mile point 22.1
- Station C6U – on Interstate H-201 at mile point 0.21
NPMRDS AND COUNT STATION SPEED PROFILES

HiDOT Stn C6-U WB at NPMRDS TMC 126P04150
Speed Comparison for March 31, 2015
NPMRDS AND COUNT STATION SPEED PROFILES

HiDOT Stn C6-U EB at NPMRDS TMC 126N04150
Speed Comparison for March 31, 2015

Graph showing speed comparison for March 31, 2015.
NPMRDS AND COUNT STATION SPEED PROFILES

HiDOT Stn C6-U EB at NPMRDS TMC 126N04150
Speed Comparison for April 1, 2015

Time of Day

Speed MPH

0 6 12 18 24

HI Stn-C6-U EB
NPMRDS_0401EB
2 per. Mov. Avg. (NPMRDS_0401EB)
HiDOT H-1 Stn H-13 WB at NPMRDS TMC 126P04120
Speed Comparison for April 1, 2015
HI DOT H-1 Stn SL71 WB at NPMRDS TMC 126P04109
Speed Comparison for March 31, 2015
NPMRDS AND COUNT STATION SPEED PROFILES

HI DOT H-1 Stn SL71 WB at NPMRDS TMC 126P04109
Speed Comparison for April 1, 2015

Speed MPH

Time of Day

HI Stn-SL71 WB
NPMRDS_0401WB
2 per. Mov. Avg. (NPMRDS_0401WB)
BEFORE AND AFTER STUDIES
KING STREET BEFORE LANE CONVERSION
TRANSIT TRAVEL TIME IMPACT

RUNNING TIME PLOT

ROUTE 1 WEEKDAY SEGMENT SUMMARIES
DIRECTION: EASTBOUND, SEGMENT: KINGPUNC-KINGPUNA

[Graph showing running time plot with actual mean runtime and scheduled runtime compared over trips 103 to 2245.]
TRANSIT TRAVEL TIME IMPACT

Average Travel time change in Seconds (+ve Increase in Travel Time-Delay)

-700 -500 -300 -100 0 100 300 500

0 6 12 18 24

Tuesday
Thursday
Friday
PALI HIGHWAY SPEED CHANGE
BEFORE AND AFTER IMPROVEMENTS

Change Pre - Post Improvements

85th % Spd
PALI HIGHWAY TRAVEL TIME CHANGE BEFORE AND AFTER IMPROVEMENTS

Box plots showing the change in 85th percentile travel time before and after improvements across different segments of the highway.
PALI HIGHWAY TRAVEL TIME (SECS) BETWEEN TMC’S
EXPLORATORY ANALYSIS

rpivotTable(vwpaliebwdpre2posamdf, rows=c("road_order","intersection"), cols="hrsmins")
TRAVEL TIME DIFFERENCE AM PEAK PERIOD

Average(TTQ85DFPS) vs hrumins by road_order-intersection

- 2-I-H1/LUNALILO FWY
- 3-I-H1/LUNALILO FWY
- 4-PACIFIC HEIGHTS RD/S KUAKINI ST
- 5-PACIFIC HEIGHTS RD/S KUAKINI ST
- 6-PAUOA RD
- 7-PAUOA RD
- 8-NUUANU AVE/WYLLIE ST
- 9-NUUANU AVE/WYLLIE ST
- 10-HI-83/AUOA RD/KAMEHAMEHA HWY
- 11-ULUHALA ST
- 12-HI-72/KALANIANAOLE HWY/ULUKAHIKI ST
- 12-ULUHALA ST
- 13-HI-72/KALANIANAOLE HWY/ULUKAHIKI ST
- 14-ULUMANU DR
- 15-HAMAKUA DR/KAINEHE ST
- 15-ULUMANU DR
SPEED STANDARD DEVIATION AM PEAK

Sample Standard Deviation (SPQ86DFPS) vs h rms mins by road_order_intersection
REFERENCES

- HPMS 2016 Field Manual and supplemental travel time manual
- Understanding NPMRDS Usage for Certain Performance Data Needs, Wenjing Pu, HIS, Nov. 15, 2017, Washington, DC
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