Question: How can traffic flow be optimized at the entrances of Innovation Academy during peak hours?

Open Sources:

* Source 1:
  + Title of source, Author of Source, Reference:

Making the Grade: School Zone Safety 101 - Susan Caldwell

* + URL / Permalink / Stable Document, URL that has been tested:

<https://www.trafficsafetysuppliers.com/blog/school_zone_safety_and_setting_up_the_school_zone/>

* + Summary:
    - Importance of setting up a well-structured school zone for safety.
    - Use of reduced speed limits, flashing beacons, and warning signs.
    - Designated drop-off zones to reduce congestion and enhance pedestrian safety.
    - Crosswalks and speed bumps as essential safety features.
    - Community involvement in traffic safety education and awareness.
    - Importance of regular safety assessments to identify and mitigate hazards.
* Source 2:
  + Title of Source, Author of Source, Reference:

School to enhance safety for pupils by reducing traffic on streets - Dr Cecilia Oram

* + URL / Permalink / Stable Document, URL that has been tested:

<https://www.sustrans.org.uk/our-blog/news/2023/december/school-to-enhance-safety-for-pupils-by-reducing-traffic-on-streets/>

* + Summary:
    - Dalry Primary School reduces traffic around its entrances through the Sustrans Temporary School Streets Fund.
    - Vehicle access is limited during school hours to improve student safety.
    - Footpaths are widened to encourage walking, cycling, and scooting.
    - The project enhances air quality and reduces traffic congestion.
    - Community involvement is integral, with features like planters and seating added to improve the environment.
* Source 3:
  + Title of Source, Author of Source, Reference:

Covid-19: Smart school-zone beacons help keep students safe from traffic as schedules change – Tom Stone

* + URL / Permalink / Stable Document, URL that has been tested:

<https://www.traffictechnologytoday.com/news/safety/covid-19-smart-school-zone-beacons-help-keep-students-safe-from-traffic-as-schedules-change.html>

* + Summary:
    - COVID-19 changes: School schedules were altered, creating challenges for maintaining safe school zones.
    - Smart school-zone beacons: A new system, the Glance Connected School Beacon, allows traffic engineers to adjust beacon schedules remotely.
    - Real-time control: Beacons can be controlled via smartphones, ensuring they operate at the right times.
    - Gwinnett County adoption: The county in Georgia uses this system to manage over 150 schools.
    - Benefits: Increases efficiency and ensures timely safety measures for students.

Historical Sources:

* Source 1:
  + Title of source, Author of Source, Reference:

Speeds in School Zones - K. Fitzpatrick, M.A. Brewer, K.O. Obeng-Boampong, E. Park, N.D. Trout

* + URL / Permalink / Stable Document, URL that has been tested:

<https://tti.tamu.edu/tti-publication/speeds-in-school-zones/>

* + Summary:
    - Objective: Review existing practices and develop guidelines for establishing school zones.
    - Research Methods: Reviewed previous research on traffic control devices in school zones.
    - Conducted a survey of practitioners on signing and marking.
    - Reviewed state and city school zone guidelines and warrants.
    - Conducted a telephone survey of law enforcement officers.
    - Collected field data at 24 school zones across Texas.
    - Key Findings: Analyzed speed-distance and speed-time relationships.
    - Examined the influence of various site characteristics on speeds.
    - Identified special characteristics of school zones with buffer zones.
    - Guidelines Developed: Definitions and characteristics of school speed zones.
    - Recommendations for pavement markings and crosswalks. Conditions for removing a school speed zone.
    - Purpose of Guidelines: Serve as a supplement to the Texas Manual on Uniform Traffic Control Devices and the manual on Procedures for Establishing Speed Zones.
* Source 2:
  + Title of Source, Author of Source, Reference:

Improving Traffic Safety at School Zones by Engineering and Operational Countermeasures - Hasibur Rahman

* + URL / Permalink / Stable Document, URL that has been tested:

<https://www.academia.edu/94121878/Improving_Traffic_Safety_at_School_Zones_by_Engineering_and_Operational_Countermeasures>

* + Summary:
    - Objective: Assess the impact of reducing speed limits from 50 km/h to 30 km/h in school zones on speed and safety.
    - Key Findings: Speed Reduction: Mean speeds and 85th percentile speeds were reduced by 12.2 km/h and 11.6 km/h, respectively.
    - Safety Improvement: Fatal and injury collisions were significantly reduced by 45.3%, and injuries to vulnerable road users were reduced by 55.3%.Speed Variation: Speed variation was reduced, and the speed cumulative distributions shifted to the left, indicating further reductions for all speed ranges.
    - Effectiveness: For every 1 km/h reduction in mean speed, fatal and injury crashes were reduced by about 4%.No Significant Spillover
    - Effects: Neither spatial nor temporal collision migration or spillover effects were significant factors in the analysis.
    - Conclusion: Reducing speed limits to 30 km/h in school zones can bring significant safety benefits by reducing vehicular speeds and improving overall traffic safety.
* Source 3:
  + Title of Source, Author of Source, Reference:

School Area Traffic Control – Safe Routes

* + URL / Permalink / Stable Document, URL that has been tested:

<https://www.saferoutespartnership.org/sites/default/files/pdf/Lib_of_Res/SRTS_Program_SchoolAreaTrafficControl_ITE_2012.pdf>

* + Summary:
    - Objective: Achieve uniformity in traffic control around school areas by treating comparable traffic situations consistently.
    - Guidelines and Tools: Signs: Use of the School (S1-1) sign to warn road users of approaching school zones, crossings, or facilities.
    - Changeable Message Signs (CMS): Allowed to display reduced speed limits within school zones, conforming to specific design standards.
    - Driver Feedback Signs: Advise motorists of their actual speeds, more effective when used with speed limit signs during active school zone periods.
    - In-Street Pedestrian Crossing Signs: Intended for use at uncontrolled crosswalks, can have a traffic-calming effect by narrowing lanes.
    - Implementation: Recommendations for the placement and use of these traffic control devices to enhance safety and manage traffic flow effectively around schools.

Current Sources:

* Source 1:
  + Title of source, Author of Source, Reference:
    - Artificial intelligence-based traffic flow prediction: a comprehensive review - Journal of Electrical Systems and Information Technology | Full Text (springeropen.com)
  + URL / Permalink / Stable Document, URL that has been tested:
    - [Artificial intelligence-based traffic flow prediction: a comprehensive review | Journal of Electrical Systems and Information Technology | Full Text (springeropen.com)](https://jesit.springeropen.com/articles/10.1186/s43067-023-00081-6)
  + Summary:
    - Discusses various AI-based traffic prediction methods.
    - Emphasizes multivariate traffic time series modeling.
    - Reviews recent advances and emerging research opportunities.
    - Highlights the importance of data preprocessing in traffic prediction.
    - Identifies primary research challenges and future directions.
* Source 2:
  + Title of Source, Author of Source, Reference:
    - Traffic Prediction using Artificial Intelligence: Review of Recent Advances and Emerging Opportunities - Maryam Shaygan, Collin Meese, Wanxin Li, Xiaolong Zhao, Mark Nejad
  + URL / Permalink / Stable Document, URL that has been tested:
    - <https://arxiv.org/abs/2305.19591>
  + Summary:
    - Provides a comprehensive overview of AI-based traffic prediction methodologies.
    - Focuses on recent advances and emerging research opportunities.
    - Emphasizes multivariate traffic time series modeling.
    - Discusses various data types and resources used in traffic prediction.
    - Highlights primary research challenges and future directions.
* Source 3:
  + Title of Source, Author of Source, Reference:
    - Traffic Flow Prediction with Vehicle Trajectories - Mingqian Li, Panrong Tong, Mo Li, Zhongming Jin, Jianqiang Huang, Xian-Sheng Hua
  + URL / Permalink / Stable Document, URL that has been tested:
    - [Traffic Flow Prediction with Vehicle Trajectories | Proceedings of the AAAI Conference on Artificial Intelligence](https://ojs.aaai.org/index.php/AAAI/article/view/16104)
  + Summary:
    - Proposes a spatiotemporal deep learning framework called Trajectory-based Graph Neural Network (TrGNN).
    - Uses historical vehicle trajectories for road traffic prediction.
    - Models spatial traffic demand via graph propagation along the road network.
    - Incorporates an attention mechanism to learn temporal dependencies
    - Achieves significant error reduction compared to state-of-the-art approaches.

Method Sources:

* Source 1:
  + Title of source, Author of Source, Reference:
    - Traffic Data Collection: Methods, Analysis, and Applications - AVUTEC
  + URL / Permalink / Stable Document, URL that has been tested:
    - [Traffic data collection: methods, analysis and applications - AVUTEC](https://avutec.com/traffic-data-collection-methods-analysis-and-applications/)
  + Summary:
    - Discusses the significance of traffic data collection for enhancing traffic control and infrastructure projects.
    - Explores various methods used to collect traffic data, including manual tracking, pneumatic tubes, inductive loops, thermal imaging, radar technology, artificial intelligence, and ANPR (Automated Number Plate Recognition).
    - Highlights the transition from manual or analog methods to AI-based automated counting procedures.
    - Emphasizes the role of traffic data in informing city planners, transport agencies, and governmental bodies.
* Source 2:
  + Title of Source, Author of Source, Reference:
    - Overview and Recommendations for Road Traffic Data Collection Methods and Applications in Ghana - Abena A. Obiri-Yeboah, Maud S. Gbeckor-Kove, Yolanda Oliver-Commey
  + URL / Permalink / Stable Document, URL that has been tested:
    - [A1102010109.pdf (ijera.com)](https://www.ijera.com/papers/vol11no2/Series-1/A1102010109.pdf)
  + Summary:
    - Provides a literature review of traffic data collection methods, including manual, mechanical, automatic, and intelligent mechanisms.
    - Discusses the advantages and disadvantages of different methods. Highlights the importance of accurate, affordable, and sustainable traffic data collection methods.
    - Recommends a shift to modern collection methods for improved project planning and management in the transportation system.
* Source 3:
  + Title of Source, Author of Source, Reference:
    - A Systematic Review on Urban Road Traffic Congestion - Umair Jilani, Muhammad Asif, Muhammad Yousuf Irfan Zia, Munaf Rashid, Sarmad Shams, Pablo Otero
  + URL / Permalink / Stable Document, URL that has been tested:
    - [A Systematic Review on Urban Road Traffic Congestion | Wireless Personal Communications (springer.com)](https://link.springer.com/article/10.1007/s11277-023-10700-0)
  + Summary:
    - Conducts a systematic review of approaches used for predicting, detecting, and analyzing congestion levels on urban roads.
    - Categorizes approaches based on datasets, results, and comparison with other available algorithms.
    - Discusses the advantages and limitations of different categorical approaches.
    - Highlights the importance of intelligent transportation systems in managing traffic congestion and promoting sustainability.

Discipline Specific Sources:

* Source 1:
  + Title of source, Author of Source, Reference:
    - Crafting a Blueprint for Safety: The Significance of Traffic Control Plans - CS Engineer Magazine
  + URL / Permalink / Stable Document, URL that has been tested:
    - [Crafting a Blueprint for Safety: The Significance of Traffic Control Plans - Civil + Structural Engineer magazine (csengineermag.com)](https://csengineermag.com/crafting-a-blueprint-for-safety-the-significance-of-traffic-control-plans/)
  + Summary:
    - Emphasizes the importance of traffic control plans in civil and structural engineering projects.
    - Discusses the impact of traffic control plans on safety, efficiency, and project success.
    - Provides a structured framework for managing vehicular and pedestrian traffic in construction zones.
* Source 2:
  + Title of Source, Author of Source, Reference:
    - Industry Spotlight: Civil Engineering & Traffic Management - AUGI
  + URL / Permalink / Stable Document, URL that has been tested:
    - [Industry Spotlight: Civil Engineering & Traffic Management | AUGI - The world's largest CAD & BIM User Group](https://www.augi.com/articles/detail/industry-spotlight-civil-engineering-traffic-management)
  + Summary:
    - Highlights the role of traffic management in civil engineering projects.
    - Discusses strategies to minimize disruption and maximize safety during construction.
    - Emphasizes the importance of traffic control plans in civil engineering.
* Source 3:
  + Title of Source, Author of Source, Reference:
    - Artificial Intelligence-Based Traffic Flow Prediction: A Comprehensive Review - Sayed A. Sayed, Yasser Abdel-Hamid, Hesham Ahmed Hefny
  + URL / Permalink / Stable Document, URL that has been tested:
    - [Artificial intelligence-based traffic flow prediction: a comprehensive review | Journal of Electrical Systems and Information Technology | Full Text (springeropen.com)](https://jesit.springeropen.com/articles/10.1186/s43067-023-00081-6)
  + Summary:
    - Provides a comprehensive review of machine learning and deep learning techniques applied in traffic prediction.
    - Discusses the integration of Intelligent Transportation Systems (ITS) in smart cities.
    - Identifies challenges and future directions in AI-based traffic flow prediction.